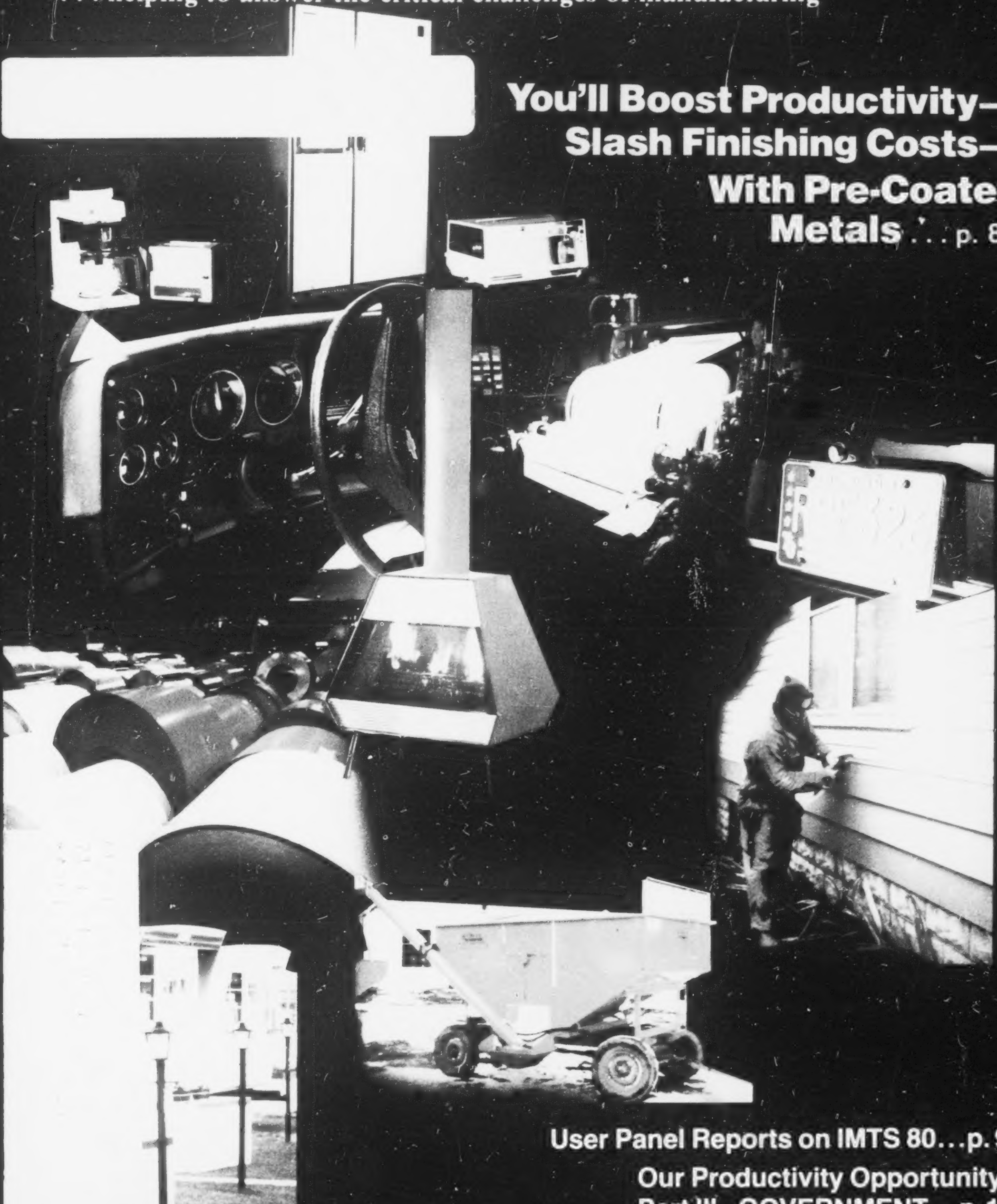
October 1980

PRODUCTION

... helping to answer the critical challenges of manufacturing



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PRODUCTION®

October 1980
Vol. 86, No. 4

It is the purpose of **PRODUCTION** to recognize and to fulfill the special needs of the managers and engineers who are responsible for improving manufacturing efficiency, costs and quality in production metalworking plants, and selected supplier industries.

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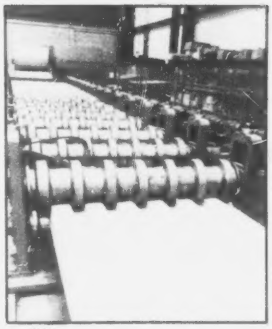

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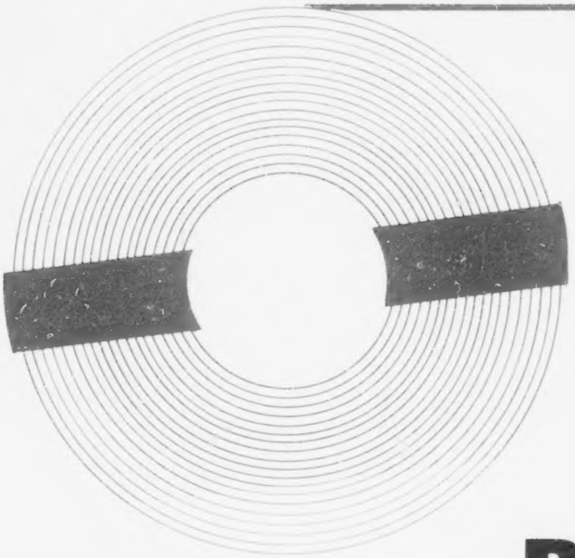


Changing material buying practices can do as much to improve productivity as motivating workers and replacing old machinery. A switch to pre-coated metals can trigger big improvements

You'll Boost Productivity—Slash Finishing Costs—With Pre-Coated Metals

Productivity is not an overworked topic. Quite the opposite. Indicators of domestic performance suggest that even more attention needs to be paid to this issue.

What is overworked are claims that the cure for declining productivity rests solely with job enrichment and quality of worklife programs designed to motivate bored workers. This is an oversimplification.

Big jumps in productivity will be triggered by accelerating research in new manufacturing techniques and by adopting technology proved but heretofore applied narrowly. Pre-coated metals fall within this second category.

Pre-coated metal is stock painted or otherwise coated on a coil-coating line with an adhesive, lubricant, weldable primer, etc., and shipped to the end user ready-to-fabricate. It is available from some mills, independent coil coaters and increasingly through metal service centers.

Gregory C. Smith, president and chairman of the board, Wolverine Aluminum Corp., Lincoln Park, MI, says: "When you use a coil-coated product you don't have to worry about productivity in your finishing operations. It is our problem."

Today's Market. There has been a tenfold increase in the use of pre-coated metals since 1962. From less than a half million tons the market has grown to about four million tons. Steel represents about 80 percent of shipments. The balance is primarily aluminum. Zincrometal currently accounts for 25 percent of shipments.

The benefits of converting to pre-painted metals are broad and often immediate. PRODUCTION questioned industry spokesmen to identify some of these benefits.

Q Why should you consider converting from post-painting to pre-coated metals?

There are several answers to this question: To improve end-product quality; to improve in-plant productivity; to reduce finishing/manufacturing costs.

Today's pre-coated product is superior to what was available ten years ago. An endless combination of metal substrates, coating formulations and finishes, and coil-coating line capabilities give end users unlimited flexibility to customize products. The coatings, which can be both functional and decorative, provide excellent consistency of color, thickness, gloss and texture. Seldom do quality standards need to be compromised.

Metal destined for the coating line is also produced to tight standards. "We don't have the hot dipped galvanized we used to have, for example," says Charles Donnelly, market planning manager-Coated Products, United States Steel Corp., Pittsburgh. "Today's mill practices minimize spangle so we don't have the big, flowery spangle relief to paint over. Steel quality, from a surface standpoint and from a shape-control standpoint, has improved."

Improvements in substrates and in coatings add up to reduced scrap. Donnelly says scrap from appliance-grade coated stock can run from 10 to 15 percent from a 40,000-lb coil depending on the critical nature of the appliance application. For material used in engineered buildings it might be half that or less. Careful in-plant handling of pre-coated metal is the key to low scrap.

"The coil coater always has to be under control," adds Ted Olt, Jr., general manager, Nichols Div., Nichols-Homeshield, Inc., Davenport, IA. "What we have if we are not under control is a high-speed method of generating scrap. For example, if we buy aluminum for $1 a lb and sell it with paint on it for $1.20 a lb we have an absolute potential to convert it to painted scrap aluminum worth 40 cents a lb. It is possible to lose from 60 to 80 cents a lb on every lb painted improperly. And at 250 fpm line speeds, it can add up to a bundle very rapidly."

In-plant productivity will improve and finishing costs will drop with the use of pre-coated metal because all operations associated with metal cleaning, rinsing, pre-treatment and painting are eliminated. This means the cost of equipment, direct and indirect labor, and any bottlenecks associated with these operations are eliminated. Freed capital, engineering skill and labor can be focused on fabricating and assembly operations.

Q Under what circumstances should a change to pre-coated metals be considered?

The agreed-upon answer to this question is at that point in time when existing paint lines become impractical to operate because of costly modifications demanded by environmental and safety regulations, or when additional finishing capacity is required.

"It is pretty hard to justify the use of pre-coated metal unless you are going to expand, move to a new location or open a new plant," says Donnelly (U.S. Steel). "If a fellow has an existing facility he can still paint cheaper than buying coil-coated material. But if he has an expansion program, or if he has an OSHA or EPA problem, then coil coating becomes pretty attractive. Then it is a different ball-game."

Energy costs are a big factor, too. According to the National Coil Coaters Assn., Philadelphia, metal can be painted on a coil-coating line using from $^1/_5$ to $^1/_6$ the energy consumed by conventional painting systems using curing ovens. In today's energy climate, this factor alone can often tilt the economic scales in favor of pre-painted metals.

Olt (Nichols-Homeshield) adds: "People should consider pre-coated metal because it is clearly to their best interest, both economically and ecologically. It is

Who's Using Pre-Coated Metals

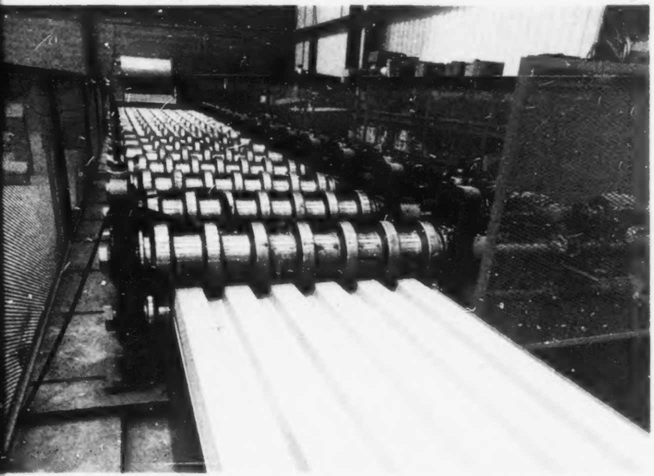
Steel (in tons)

• Passenger Automobiles	782,114
• Industrial Rural Buildings	965,502
• Lighting Fixtures	81,085
• Trucks, Trailers & Shipping Containers	36,137
• Shelving & Fixtures	35,509
• Heating, Water Heating & Water Softening Equipment	30,798
• Container Strapping & Seals	41,974
• Portable Buildings & Parts	28,995
• Metal Doors & Windows	36,053
• Refrigerators & Freezers	41,898

Aluminum (in tons)

• Residential Siding	124,987
• Cans, Ends & Tabs	192,073
• Service Centers & Dist.	8,426
• Mobile Homes	56,313
• Travel Trailers & Campers	15,138
• Trucks, Trailers & Shipping Containers	19,880
• Awnings & Canopies	28,639
• Rain Carrying Equipment	27,858
• Industrial Rural Buildings	19,106

Source: NCCA



Roll forming is one of the most suitable methods for shaping pre-coated metals. At Wolverine Aluminum Corp., Lincoln Park, MI, the industry's fifth largest coil coater, it is used extensively to produce product for the building industry

something that has to be looked at. Many smaller companies probably haven't faced the ecological pressures that some of the larger companies have on air, water and solids. But they will. Therefore, any company with in-house painting is a candidate for using pre-coated material."

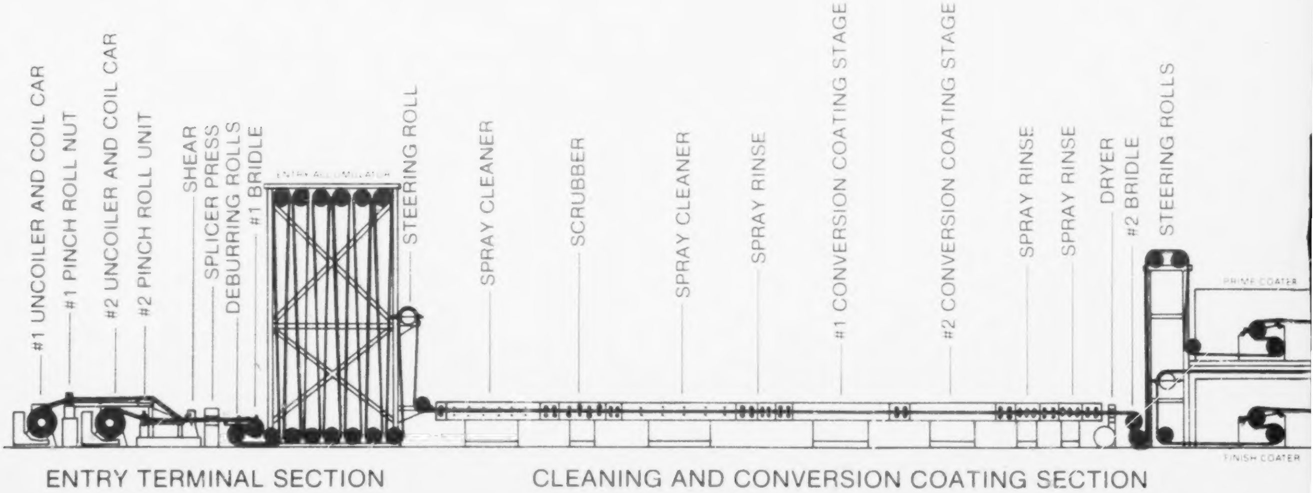
"In the final accounting," adds Smith (Wolverine Aluminum), "basic economics will make the difference." He says you need to look at your current finishing costs and compare these to the cost of using pre-coated metals. (The Coil Coaters Assn. has forms to assist you in doing this.)

Although there is no price book on painted stock, Smith did provide these guidelines. "Coating charges on appliance-quality finishes will result in about a 33 percent markup over the steel. Zincrometal, depending upon the finish, has probably a 10 to 12 percent markup over the base metal. Of course, we can provide a finish that costs more than the base metal. Special fluorocarbon colors for industrial buildings, for example, could represent a 150 percent markup over the steel. But, overall, a 20 to 25 percent markup is what you are going to have over the base metal."

Q What are the characteristics of a good candidate part for pre-coated metal? "The first thing to look at," says Donnelly (U.S. Steel), "would be a part that has some kind of finish coat now. Of course, it is almost automatic that you have to take into consideration the design of the product. You have to be willing to bend designs to allow for more liberal radii and, of course, you can't weld sheet as you have in the past."

Basil Davies, corporate manager, marketing—Coated Products, National Steel Corp., Pittsburgh, says: "A good candidate has to be one that isn't going to be a deep draw application. Something that is going to be roll formed or formed on a press brake is a better candidate because when you deep draw the problem would be disruption of the paint film. Applications which do not require surface finishing beyond the pre-coated finish also tend to be better candidates."

"Also very logical candidates for coil-coated stock


#1 UNCOILER AND COIL CAR
#1 PINCH ROLL NUT
#2 UNCOILER AND COIL CAR
#2 PINCH ROLL UNIT
SHEAR
SPLICER PRESS
DEBURRING ROLLS
#1 BRIDLE
ENTRY ACCUMULATOR
STEERING ROLL
SPRAY CLEANER
SCRUBBER
SPRAY CLEANER
SPRAY RINSE
#1 CONVERSION COATING STAGE
#2 CONVERSION COATING STAGE
SPRAY RINSE
SPRAY RINSE
DRYER
#2 BRIDLE
STEERING ROLLS
PRIME COATER
FINISH COATER
ENTRY TERMINAL SECTION
CLEANING AND CONVERSION COATING SECTION

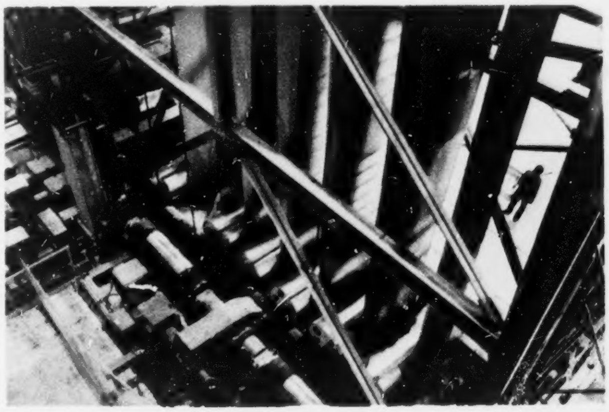
are parts that are difficult to paint in a conventional manner," says Gerry Grob, senior product specialist-Coated Products, Eastern Steel Div., Armco, Inc., Middletown, OH. "An example is where one is looking for different colors between sides, say, black on one side and white on the other. In a spray system or dip system this is about impossible unless you go with a lot of masking. For us, it is like falling off a log."

Grob says: "There are also a lot of little parts that are hard to paint conventionally, parts like automotive mirror housings and breather caps, and lighting fixtures. With pre-coated stock you can just stamp these parts out."

Q What technical developments should a potential user of pre-coated stock be aware of?

Certainly high on the list of recent developments is the expanding capability of coil-coating lines. John Benson, vice president, sales, Roll Coater Inc., Greenfield, IN, says: "Until recently there has not been very much coil-coating capability that could really handle heavier gage material. But with the building of some newer lines the industry has the capability of handling thicknesses of up to .125 in. This expands areas where design engineers can look to pre-painted metals. In the past we had to be content with .050 in.

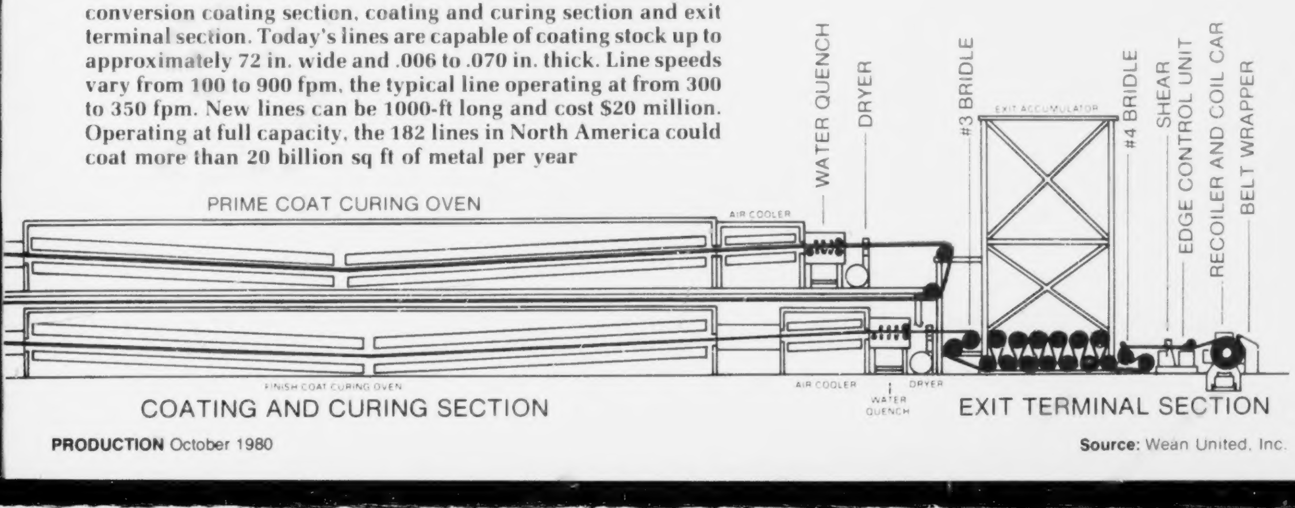
"With this new equipment capability, the coil-coating industry is really opening up areas that previously wouldn't be potential markets. An example would be culvert stock formed from coated galvanized as a replacement for concrete culvert pipe."



Roll Coater's No. 5 line in Kingsbury, IN, is one of the world's largest lines. It coats heavy gage material, up to .125 in., and has maximum width capacity to 72 in. It operates at speeds of up to 800 fpm

Formability. This has long been a question mark. It is a problem being overcome today, however. Roll Coater says zero-T bends are no problem now. "This is a success story at General Electric, Decatur, AL, where the first all-coated-coil refrigerators were produced in 1977.

"GE needed a paint system approaching the hardness and durability and stain resistance it would get with post-painting refrigerators. In order to get this and still have the configuration it wanted for door stock and wrappers, GE expected that it would have to make design and finish compromises," says Benson.



The 182 coil coating lines in North America are all designed around four basic elements: entry terminal section, cleaning and conversion coating section, coating and curing section and exit terminal section. Today's lines are capable of coating stock up to approximately 72 in. wide and .006 to .070 in. thick. Line speeds vary from 100 to 900 fpm, the typical line operating at from 300 to 350 fpm. New lines can be 1000-ft long and cost $20 million. Operating at full capacity, the 182 lines in North America could coat more than 20 billion sq ft of metal per year

Source: Wean United, Inc.

HERE'S YOUR GUIDE TO DOMESTIC COIL COATERS

Steel and Aluminum

Revere Aluminum Building Products, Inc.
Franklin Park, IL
(312) 455-7200

Pre-Finish Metals, Inc.
Elk Grove Village, IL
(312) 439-2210

Litho-Strip Co.
Chicago
(312) 254-3400

Roll Coater, Inc.
Greenfield, IN
(317) 462-7761

Wolverine Aluminum Corp.
Lincoln Park, MI
(313) 386-0800

Nichols-Homeshield, Inc.
Davenport, IA
(319) 324 2121

American Metals Corp.
Westlake, OH
(216) 871 8000

Elwin G. Smith Div.
Cyclops Corp.
Pittsburgh
(412) 761-7474

Plasteel Products Corp.
Washington, PA
(412) 222-7400

Enamel Products & Plating Co.
McKeesport, PA
(412) 461-2780

Prior Coated Metals Co.
Allentown, PA
(215) 797-5200

Southeastern Coated Products
Columbia, SC
(803) 771-7920

Hunter Douglas, Inc.
Roxboro, NC
(919) 599 2152

Levolor Lorentzen, Inc.
Hoboken, NJ
(201) 792-2600

Chesapeake Finished Metals, Inc.
Baltimore
(301) 796-4770

Teledyne Rodney Metals
New Bedford, MA
(617) 996-5691

Howmet Aluminum Corp.
Mesquite, TX
(214) 285-8811

Supracote, Inc.
Rancho Cucamonga, CA
(714) 987-4711

California Finished Metals, Inc.
Cucamonga, CA
(714) 987-4681

Hexcel Corp.
Dublin, CA
(415) 828-4200

Steel Coaters

Armco, Inc.
Middletown, OH
(513) 425-2326

National Rolling Mills Co.
Paoli, PA
(215) 644-6700

Inryco, Inc.
Milwaukee
(414) 383-4030

Republic Steel Corp.
Coil Coating Div.
Youngstown
(216) 783-4431

Pittsburgh-Canfield Corp.
Canfield, OH
(216) 533-3311

Wheeling Corrugating Co.
Div. Wheeling-Pittsburgh
Steel Corp.
Wheeling, WV
(304) 234-2548

United States Steel Corp.
Pittsburgh
(412) 433-3974

Dynacure Pre-Coated Steel
Cornwells Heights, PA
(215) 639-0686

Precoat Metals Div.
Chromalloy American Corp.
St. Louis
(314) 352-8000

Roper Eastern
Columbia, MD
(301) 992 6700

Aluminum Coaters

Aluminum Co. of America
Pittsburgh
(412) 553-4545

Consolidated Aluminum Corp.
Coated Products Div.
St. Louis
(314) 878-6950

Bendix Modern Materials Corp.
Detroit
(313) 841-4422

Alumax Mill Products
Willowbrook, IL
(312) 986-9688

Martin Marietta Aluminum Corp.
Lewisport, KY
(502) 295-3451

Alcan Aluminum Corp.
Sheet & Plate Div.
Warren, OH
(216) 841-3331

Kaiser Aluminum & Chemical Corp.
Toledo, OH
(419) 729-4601

Reynolds Metals Co.
Richmond, VA
(804) 281-2000

Coated Material Suppliers

Atlas Steel Co., Inc.
Chicago
(312) 346-5960

Bethlehem Steel Corp.
Bethlehem, PA
(215) 694-5691

Inland Steel Co.
Chicago
(312) 346-0300

Jones & Laughlin Steel Corp.
Western Div. Headquarters
Whiting, IN
(219) 659-8380

Interstate Steel Co.
Des Plaines, IL
(312) 827-5151

National Steel Corp.
Pittsburgh
(412) 263-4380

United States Steel Supply
Chicago
(312) 646-3211

Steel Service Centers

Source: NCCA

"GE worked with Roll Coater and Inland Steel Corp. to install heaters on the roll forming lines to preheat the metal before it was formed. The material was elevated to approximately 130 F, the glass transition temperature of the coating, to make it more flexible during forming. As a result, GE obtained the T-bend it wanted—improved a couple of T-bends over what it had anticipated—and did not have to compromise the coating."

"When you address formability," says Grob (Armco), "you need to have the mutual cooperation of the substrate supplier, painter, paint formulator and end user. The end user may have to sacrifice a little something in hardness or gloss on occasion, but generally we can whip the problems."

"Normally speaking," adds Smith (Wolverine

Aluminum), "if the base metal will make the part we will have a coating that will do the job. The fact that we can deep draw a piece of steel four in. for a speedometer case, and not have the paint separate from the metal, demonstrates the type of technology that is available."

Olt (Nichols-Homeshield) agrees that tremendous progress has been made in deep drawing pre-painted metal. "But sooner or later," he adds, "you will run out of stretch in your paint. You can probably do a shallow draw pretty easily, but you probably can't do a beer can. A rule of thumb is 1½ times diameter."

Weldability. On this issue Grob (Armco) says: "Welding without a zinc-rich primer is pretty darn tough. There is some projection welding that has been flirted with, but in most cases you need to look at riveting, adhesive bonding or some other joining method."

Basil Davies (National Steel) adds: "Joining problems have to be overcome in many applications. If it is a welded application you are going to have a problem. Welding on a production basis is impractical under most conditions. You can, however, use epoxy, stitching, lockseaming or other methods to overcome this obstacle." There are also weldable primers which can be applied to a moving coil as a base coat and then overlayed with a second coat which leaves bare, say, two inches of primed metal along the edge of the material.

Q What are the primary new markets opening up for pre-coated metal?

There is wide agreement that the appliance industry is where the major growth of pre-coated metals is centered. Grob (Armco) fosters some doubt whether appliance makers will use pre-coated stock for top-of-the-line products. However, he believes there will be some move for products like air conditioners and home heating equipment.

Davies (National Steel) sees farm equipment as a potentially large market. The appliance market and the automotive market beyond Zincrometal also stand out.

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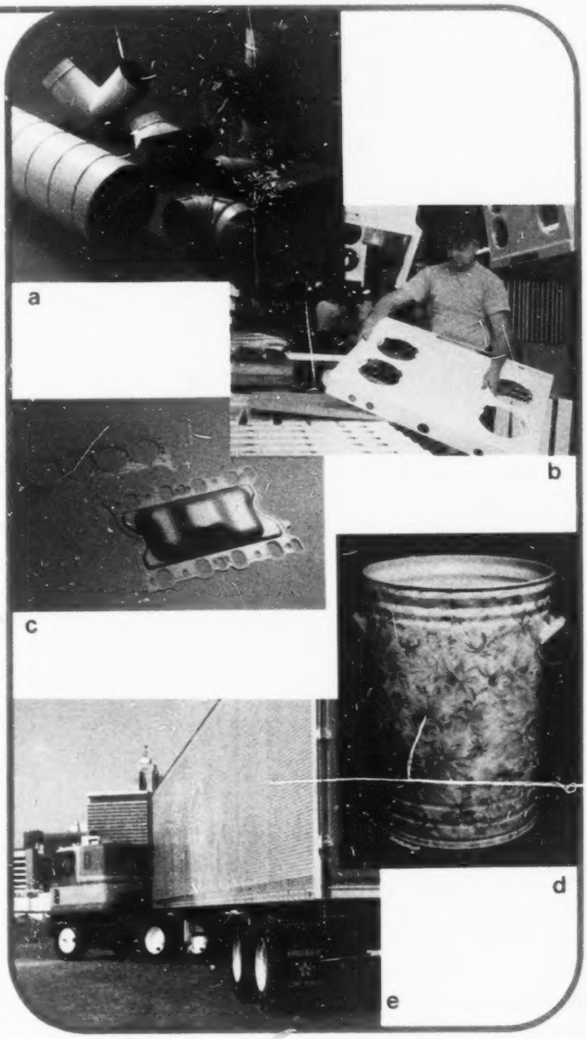
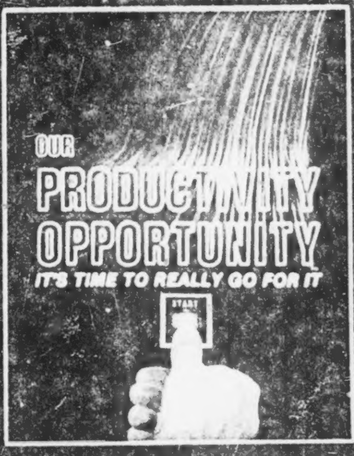


Market penetration by pre-coated metals is broad and diversified. Wolverine Aluminum sees equipment for home heating units and automotive parts *(photos A and C)* as growth markets. Bethlehem Steel is providing material for the fast-growing appliance market *(B)* and National Steel has been successful with the truck body market *(E)*. Schleuter Mfg. Co. won an award for its "fancy can." Sixteen colors were applied in one pass using a special coil coating process *(D)*

John Benson (Roll Coater) says future growth and penetration will be in the appliance industry. He further believes pre-painted metal will prove suitable for top-of-the-line appliances. Farm implements will offer broad opportunities, too, as will the thousands of fabricated products now post-painted.

"There are going to be changes in the mix of applications served by coil coaters," concludes Smith (Wolverine Aluminum). "We have tapped all the 'easy' markets. The increased capacity of the industry is now forcing us to go out and beat the bushes for new applications." *Brian D. Wakefield* □

Our Productivity Opportunity — Part III



Government & Industry... Time for a Partnership

This is the third in a triad of articles. Each article is devoted to a specific facet of the Productivity Opportunity:

Part I — **People,** June issue
Part II — **Technology,** August issue
Part III — **Government,** this issue

In launching the series in June, we wrote: "It's Time To Really Go For It." Thus, the series is about things we can all do, now, to alleviate the productivity problem in our own jobs and in our own companies. More than enough hand-wringing has been done on the subject of U.S. productivity. It would be folly to think any manufacturing man is unaware of the problems.

This series presumed, in addition to awareness of the problems, the ability/authority of the reader to take steps toward solving them. Each article sets out guideposts which can be evaluated, selected from, and tailored to unique situations in any plant.

In June, we identified a wide variety of techniques that can be used to enlist the support of every segment of labor and of management in boosting productivity. We cited 23 approaches, which you could use singly or in combination to get more people working more productively.

In August we told about the underutilization of available technology by U.S. industry. We cited some of the technologies that are ready for immediate and extensive exploitation. And we presented a working outline to help you evaluate where you now are and to target where you should be going. We also listed 31 sources of help which can assist you in knowing more about new and developing technologies and in applying them to your own operations.

In this issue, we implore government to become a full partner with industry in productivity improvement. But equally important, we tell specifically what industrialists think government must do . . . and what it must *not* do. Finally, it suggests what you and your peers in industry can do to assure that government officials see the problems and the solutions clearly.

This series provides you with working knowledge of some of the many-faceted aspects of raising productivity. If you have missed any of the installments, let us know. We also hope you'll keep us posted on your progress.

Most important, we hope the ideas presented in these articles help you directly in your quest for more productivity. *Robert F. Huber* ◻

(continued)

President Jimmy Carter calls for "reindustrialization." Presidential Candidate Ronald Reagan says we "must get the country moving again." The Council of Economic Advisors declares, "improved investment performance is almost surely a necessary condition for higher productivity growth." The chairman of the Council on Wage & Price Stability says: "As a kind of long-term development in our country we've got to devote a larger portion of our resources to capital investment." A large number of legislators from both houses of Congress and from both sides of the aisle boast of their roles in introducing and sponsoring business tax-reducing bills. And the House Ways and Means Committee and the Senate Finance Committee hear near-unanimous testimony from business and industry groups and individuals on the urgent need for depreciation reform.

American productivity is almost, but not quite, "Topic A" for our government leaders. For the moment, the state of the economy and the upcoming election have nudged it slightly to one side.

There is a possibility that this Congress and this Administration will even yet act decisively on the productivity-stimulation issue. Certainly what needs to be done is clearly understood. The timetable is the major question mark and political factors may be the determinant.

A strong call now from private individuals to this government for leadership action that will encourage the business community to increase its productivity-improving investments is imperative.

James A. Gray, president of the National Machine Tool Builders' Association, provides you, the readers of PRODUCTION, with a pattern for your request for this kind of action:

"I would like to impress on everyone in America—particularly those who are running for election and those who will be in the next Congress and Administration of the United States—that the need for productivity improvement in America is not just a passing fad.

"Some people seem to believe that the productivity improvements achieved by our industrial competitors in Japan and Germany are due to the rebuilding efforts from World War II. But World War II ended nearly 30 years ago, and the average age of machine tools in other nations is less than ten. The industrialized nations of the world have rebuilt their plants more than once since World War II. Their productivity growth is a direct result of their savings and investment in the future of their national economies."

(Ed. note: A table showing the percentage of GNP going into capital investment for various industrialized countries appears as Chart 1, below.)

"We in America seem to have forgotten that investment was the key that unlocked the door of prosperity for the United States," Gray continues.

"New investment in productivity-improving plant and equipment is what creates new jobs. Jobs for Americans cannot be created out of thin air. They can only be created by putting up the bricks, mortar and iron that are necessary to provide the tools for an expanding workforce.

"Some Americans seem to have forgotten that it is savings, investments and the resulting productivity improvement of the last 100 years that made America the most powerful nation on the face of the earth and gave Americans the standard of living that set the goals for the rest of the world.

"We must remember this economic fact of life and we must do everything possible to increase our savings and investment in America's future," Gray stresses.

The relationship of productivity's growth and capital investments is shown in Chart 2 on facing page, prepared by NMTBA.

The influence of tax incentives on capital equipment investment is clearly indicated in NMTBA's Chart 3.

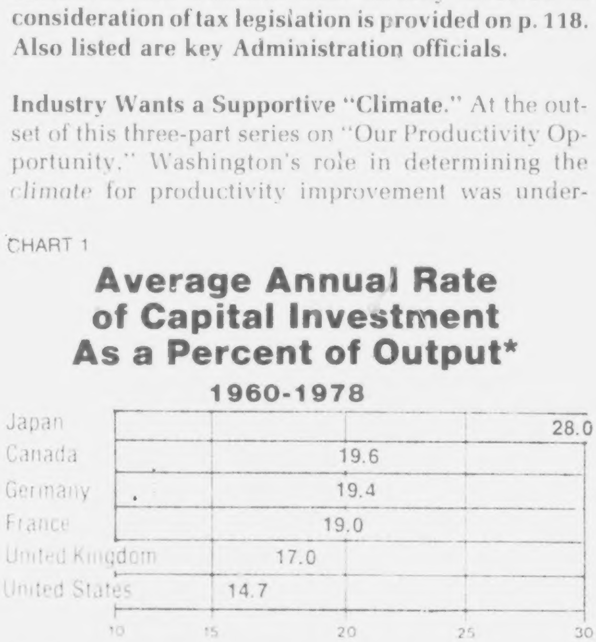
For your convenience in letting the appropriate people in the government know your opinion on the kinds of action they should be taking, a list of Representatives and Senators most directly involved in consideration of tax legislation is provided on p. 118. Also listed are key Administration officials.

Industry Wants a Supportive "Climate." At the outset of this three-part series on "Our Productivity Opportunity," Washington's role in determining the *climate* for productivity improvement was under-

CHART 1

Average Annual Rate of Capital Investment As a Percent of Output*

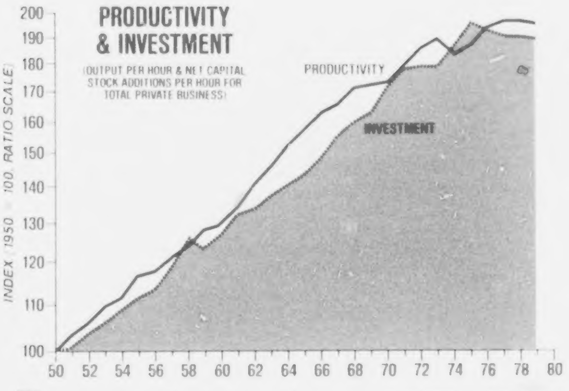
1960-1978



Source: U.S. Department of Labor, Office of Productivity and Technology, July 1980. (Presented by George A. Strichman, chairman, Colt Industries Inc., to House Ways & Means Committee July 29, 1980

*Excludes residential housing

CHART 2



scored. Many of industry's pending decisions for changes in manufacturing operations that aim at boosting productivity through equipment purchase hinge on an improvement in that climate.

It is an almost universal opinion by articulate industry members that government should take four actions to help industry:

- First, it should provide aids to capital formation and capital recovery that would be competitive with those available in other industrialized nations;
- Second, it should open up the patent procedure on government-owned inventions;
- Third, it should stimulate cooperative research and development efforts;
- Fourth, it should relax or rescind production- and productivity-stifling regulations whose costs exceed their benefits.

Otherwise, says an almost unanimous chorus: "Keep hands off!"

The strength of this viewpoint is acknowledged by Elmer B. Staats, Controller General of the U.S., who last fall said: "We at the General Accounting Office are well aware of private sector resistance to government intervention in business.

"In the fall of 1977, GAO sent questionnaires to 1200 firms throughout the country to obtain their perspectives on productivity and to determine whether there is an appropriate role for the federal government. A vast majority of these firms said they did not want federal assistance, and most were adamantly opposed to any further government interference in private sector operation. Given a choice between receiving technical or financial help from the federal government or from private sector institutions, 85 percent opted for private sector assistance," he reported.

PRODUCTION asked the participants at its Productivity Round Table in Chicago (June issue, p. 86) what they believe are the appropriate roles for government in stimulating American productivity.

A change from the stifling effect of present government regulations was their first recommendation.

"I find, in reviewing the financial impact of government influence, that over just the past three years 7 percent of my factory cost increases are directly attributable to government regulations," said Gerald Thompson, vice president-manufacturing, Ekco Housewares Co., Franklin Park, IL.

"We're all highly subject to OSHA inspections and EPA regulations. Not that they're not necessary—everyone owes it to every employee to provide a safe environment in which to work . . . and I don't subscribe to killing fish either. But I think that in the present situation there's a pendulum effect, and I think the government just has to recognize that moderation is necessary to avoid really destroying our American capability," he concluded.

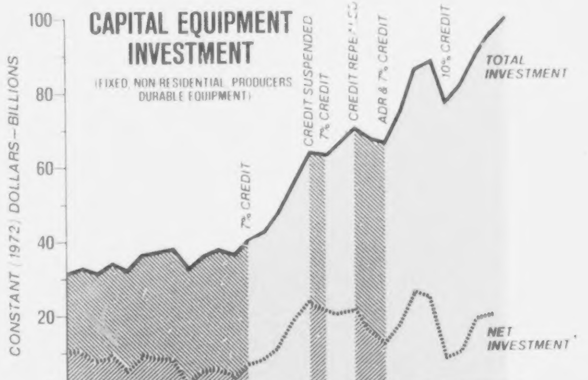
Exclaimed Jim Drzewiecki, plant manager, Acco International Inc., Wheeling, IL: "There is one thing I can think of that the government has done that is beneficial from the standpoint of productivity: They have set the best example of what *not* to do!"

"I made the comment that they should get out, but they're not going to get out," Robert Klimpel, vice president-manuacturing, A.B. Dick Co., Niles, IL, counseled.

"We collectively brought them in because we weren't doing an adequate job in worker safety and preservation of the environment. But they came in at a level where they don't have an understanding of industrial operations. And, unfortunately, we don't have an organization for industry that, in my opinion, can be heard by the government—we're too splintered. The unions do extremely well in this regard and we can learn some lessons from them."

"I agree that we should have a withdrawal of the government from the private sector," added Muzzamil Niazi, vice president-manufacturing, North American Operations—Payline Group, International Harvester Co., Schaumburg, IL "but I would hope

CHART 3



*Net Investment is not available for 1979.

Prepared by NATIONAL MACHINE TOOL BUILDERS ASSOCIATION

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that the deregulation process is gradual, otherwise there will be chaos in the marketplace."

In a more positive vein, several of the participants identified a more liberal and realistic depreciation policy as the other thing they need from government.

"The proposed Capital Cost Recovery 10-5-3 program we have been reading about would give more incentive for investment," Niazi noted. "There is enough economic history to show that incentives to industry that increase capital investment have played a role—a major role—in America's past productivity growth.

"From what I've heard, the Japanese government has helped its industry substantially in becoming strong. If we had some of these same incentives, I think we'd use them," he predicted.

Desire for action of this type was echoed by Walter Feldmahr, vice president-manufacturing, Acco International: "It would be helpful to us if we were allowed shorter depreciation periods by the government. With a ten-year requirement, we can't 'make it' for some of the more expensive equipment we could effectively use."

The "Climate" Improves. A.B. Dick's Klimpel erred in calling industry's voice "too splintered" to be heard by government.

This summer, to an unprecedented extent, the voices of business and industry were single-purpose and were heard by unusually attentive ears in Washington.

Discussions by PRODUCTION with more than a dozen major business-related associations and with members of the staffs of the tax-proposing Congressional committees affirm both the unified position of the business community for a more lenient policy on recovery of capital and the sympathetic consideration of Congressional leaders for such action. Of perhaps even greater importance for the long haul is the evidence of beginnings of a cooperative rather than an antagonistic spirit between business, labor and usually partisan factions in the government.

The tone of this cooperative attitude was set this year by Sen. Lloyd Bentsen (D, TX) in his introduction to the Report of the Joint Economic Committee of the Congress in response to the President's annual Economic Report.

Chairman Bentsen wrote: "The Majority and Minority Members of the Joint Economic Committee have risen above political partisanship in this election year to once again issue a unified annual report . . . The Committee recommends that fully one-half of the next tax cut be directed to enhancing saving and investment in the economy . . . The Committee's 1980 report recognizes that continuation of the historic adversary relationship among government, business and labor is a major impediment to implementation of supply side policies to improve productivity . . . "

The ranking minority member of the Committee, Rep. Clarence J. Brown (R, OH), added: "To achieve another consensus report, this time in a national election year, is a remarkable accomplishment, attesting to the soundness of the policy recommendations contained therein.

"The 1980 Joint Economic Committee Report is not a vague compromise of mushy logic. It is a clarion call to get this country moving again. And it offers a new, clear set of policies to generate real, sustainable economic growth without inflation. It is forthright, revolutionary, and important."

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Emphasis on "Supply Side." This report, which merits study by everyone interested in the subject of America's eroding productivity, contains 32 recommendations.

The report is notable for many things, the most important of which is, as stated by Sen. Bentsen, that it "signals the start of a new era of economic thinking."

The past, he says, "has been dominated by economists who focused almost exclusively on the demand side of the economy." Now, the Joint Economic Committee "recommends a comprehensive set of policies designed to enhance the productive side, the supply side of the economy."

The Committee, he adds, "is now on record in support of the view that tax policy can and should be directed toward improving the productivity performance of the economy over the long term and need not be enacted only to counter a recession."

The rhetoric of both political parties' conventions and platforms to the contrary notwithstanding, Sen. Bentsen, with these remarks, set the likely tenor for what major tax legislation ultimately will be enacted.

The political appeal of an immediate tax cut heavily slanted toward individual taxpayers rather than a major tax reform that would emphasize business stimulation may prevail this fall, but many knowledgeable Capitol Hill watchers doubt that it will. The strength of the current Administration's resolve against that lure and resistance of several Congressional leaders to be stampeded may be key factors.

In fact, to head off legislative action of the currently pending tax-reduction bills was the reason for the Administration's announcement on Aug. 28 of the contents of its proposed economic package, which it wants considered by next year's Congress.

Disparagingly called an "economic Christmas tree" because of its comprehensiveness and its content of something for everybody, the package would provide for 40 percent faster depreciation of capital assets than the current regulations. Fifty-five percent of its proposed benefits are calculated to accrue to business. It however, is also strongly aimed at job creation as well as tax reduction.

Current Legislative Proposals. A large number of tax bills, calling for lower personal and business taxes, have been introduced in the House and Senate and are currently being considered by the House Ways & Means Committee [under the chairmanship of Rep. Al Ullman (D. OR)] and the Senate Finance Committee [under the chairmanship of Sen. Russell B. Long (D. LA)].

The so-called "10-5-3" "Capital Cost Recovery" bills—H.R. 4646, introduced by Representatives James R. Jones (D. OK) and Barber B. Conable, Jr. (R. NY), and S. 1435, introduced by Senators Gaylord Nelson (D. WI), Lloyd Bentsen (D. TX), Robert Packwood (R. OR), and John H. Chafee (R. RI)—have wide Congressional backing and appear to have greatest industry/business support. S. 1435, for example, was sponsored by 70 Senators. These provide for a ten-year capital recovery period for buildings, five years for equipment and three years for light vehicles.

Hearings on these bills and other tax proposals by both the House and Senate committees in late July/early August produced nearly unanimous support from corporate executives and from representatives of major business and trade associations.

To lessen the immediate tax revenue loss of 10-5-3, it provides for a five-year phase-in of its full depreciation provisions for equipment and buildings. The ultimate effective depreciation schedule of 10-5-3 as it is presently written is presented in Table 1, below.

Some persons and groups favor a tax system that would have an indexing factor to allow depreciation amounts to vary with the inflation rate. Table 2 shows the effects of Simplified Cost Recovery (SCR) (Rep. Ullman's bill) and Asset Depreciation Range (ADR) with Indexing as well as 10-5-3. Table 3 (next page) looks at the tax benefits provided by depreciation under straight line accounting, ADR, and 10-5-3.

Congress is extremely mindful of what inflation has done to individuals' higher tax liabilities through "bracket creep." Its members also realize the total inability of businesses to recover the replacement costs of plant and equipment through current "useful life" depreciation allowances.

TABLE 1

Capital Cost Recovery Table (10-5-3)

Recovery Year	Class 1 (Buildings)	Class 2 (Equipment)	Class 3 (Light-duty vehicles)
1	10%	20%	33%
2	18	32	45
3	16	24	22
4	14	16	
5	12	8	
6	10		
7	8		
8	6		
9	4		
10	2		

TABLE 2

Capital Cost Recovery Comparisons — Summary of Present Value, $10,000 Investment

Tax Benefit of Depreciation Investment Tax Credit Using Current and Three Proposed New Methods*

		Methods			
	Present Lower Limit Asset Depreciation Range (ADR) Life	Current ADR	ADR With Indexing	Simplified Cost Recovery (SCR) (H.R. 7015)	Capital Cost Recovery Act (10-5-3) (H.R. 4646 & S. 1435)
Assumptions: [illegible]					
Vehicle	3 yrs	$4,453	$4,819	$4,700	$4,742
Heavy Machinery	10 yrs	4,161	[illegible]	4,664	4,823
Industrial Plant	20 yrs	3,339	4,803	[illegible]	4,823
Building	40 yrs	1,128	[illegible]	[illegible]	3,198
Assumptions: [illegible]					
Vehicle		[illegible]	$4,823	$4,576	$4,627
Heavy Machinery		[illegible]	[illegible]	[illegible]	4,641
Industrial Plant		3,021	4,685	3,467	4,641
Building		316	[illegible]	1,343	2,922

[illegible]

The disparity of our capital recovery tax laws compared with those of competitive nations was a major point also registered by many of the business spokesmen at the Congressional hearings.

Among other tax bills presently under consideration, some propose tax relief for R&D funding, some propose offsets for the increased heavy Social Security tax bite scheduled to go into effect Jan. 1, and others want changes to the present double taxation on corporate profits and shareholders' dividends, to name a few of these proposals.

A massive overhaul of the tax structure, rather than the conventional piecemeal approach, would apparently be industry's preference. But the demand generally is for whatever can be passed—as quickly as possible.

How "Big" Is Business? While business now hopes for an end to the short-range expedient "fine-tuning" types of action that Congress and the Administration have been prone to take, and the beginning of a long-range, supportive, stable and dependable legislative and regulatory environment, the dedication of business to that same degree of discipline is not especially outstanding.

On-again, off-again decisions with respect to capi-

TABLE 3

Comparison of Tax Benefits from Three Depreciation Methods*

Assumption: Office equipment costing $100,000. Purchase date 7-1. IRS recommended life 10 years. ADR life 8 years. No salvage value.

STRAIGHT LINE METHOD	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Cost	$100,000				
Current Depreciation	5,000	10,000	10,000	10,000	10,000
Tax Effect @ 46%	2,300	4,600	4,600	4,600	4,600
Investment Tax Credit	10,000				
Cumulative Tax Benefit	$ 12,300	$16,900	$21,500	$26,100	$30,700
ASSET DEPRECIATION RANGE — 200% Declining Balance					
Cost	$100,000				
Current Depreciation	12,500	21,875	16,406	12,305	9,229
Tax Effect @ 46%	5,750	10,063	7,547	5,660	4,245
Investment Tax Credit	10,000				
Cumulative Tax Benefit	$ 15,750	$25,813	$33,360	$39,020	$43,265
"10-5-3"					
Cost	$100,000				
Current Depreciation	20,000	32,000	24,000	16,000	8,000
Tax Effect @ 46%	9,200	14,720	11,040	7,360	3,680
Investment Tax Credit	10,000				
Cumulative Tax Benefit	$ 19,200	$33,920	$44,960	$52,320	$56,000

[illegible]

tal investments are not totally tax law-related. The tendency of many business managers to be measured by and governed by their companies' quarterly and annual financial reports has come under heavy editorial fire recently. Projects with probable benefits in the long term play poor second fiddle to those with immediate payoffs.

This tendency runs counter to that taken by our major international manufacturing competition, where long-range major commitments to basic productivity-improving investments are routinely made. Four examples of this were given in Editor Robert Huber's August 1980 editorial (p. 5). He observed: "Where we come up short is in the utilization of methods and of technologies that are known and available to us."

Pressure on U.S. industry to adopt a longer-range view with respect to risk-taking insofar as R&D, product development and purchasing of state-of-the-art equipment are concerned may come with the now-increasing invasion of foreign capital and management philosophies. Seeing at close range how these companies and managers operate may offer an American executive a new type of postgraduate course in capital investment analysis and decision-making.

The adaptability of American business to change is today as much at test as the government's. Outside of issuance of financial reports, however, it has no obligation to present its collective "Economic Report to the Nation." Its reaction through tangible investments to the government-promised business-stimulating reforms will show its "bigness" in looking to its long-range economic vitality.

It's Up to Us. PRODUCTION has presented a picture of America's productivity as a three-legged stool supported by people, as managers and rank-and-file, with their individual and collective motivations and effectiveness; by technology, in the development of which America still leads the world; and by government, whose role ideally is supportive and not unduly restrictive of the actions of its private and corporate citizens.

A country's business managers can neglect their responsibilities to any of these three "legs" at their peril. That's happened before in other once-great industrial nations.

Thankfully, for America at this moment, our productivity is not on a deathbed where crisis actions that may or may not be successful need to be taken. No desperation attempts at resuscitation are necessary.

We know the kinds of preventive medication we should be taking. The productivity improvement opportunity is ours to seize, or . . . □

Howard C. Tuttle

MAKE YOUR VIEWS KNOWN

Following are some of the individuals directly involved with government tax policy. If you have an opinion on what help industry needs from government to help stimulate its productivity, write to any or all of these officials:

YOUR CONGRESSMAN

YOUR TWO SENATORS

PRESIDENT JIMMY CARTER
The White House
Washington, DC 20500

G. WILLIAM MILLER
Secretary of the Treasury
Department of the Treasury
15th St. and Pennsylvania Ave
Washington, DC 20220

CHARLES J. SCHULTZE
Chairman, Council of Economic Advisors
Old Executive Office Bldg
Washington, DC 20506

Rep. Al Ullman, (D, OR), Chairman
Rep. Barber B. Conable, Jr., (R, NY),
Ranking Minority Member
House Committee on Ways and Means
1102 Longworth Bldg
Washington, DC 20515

Sen. Russell B. Long, (D, LA), Chairman
Sen. Robert Dole, (R, KS),
Ranking Minority Member
Senate Committee on Finance
2227 Dirksen Bldg
Washington, DC 20510

Sen. Lloyd Bentsen, (D, TX), Chairman
Rep. Clarence J. Brown, (R, OH),
Ranking Minority Member
Joint Committee on Economics
G-133 Dirksen Bldg
Washington, DC 20510

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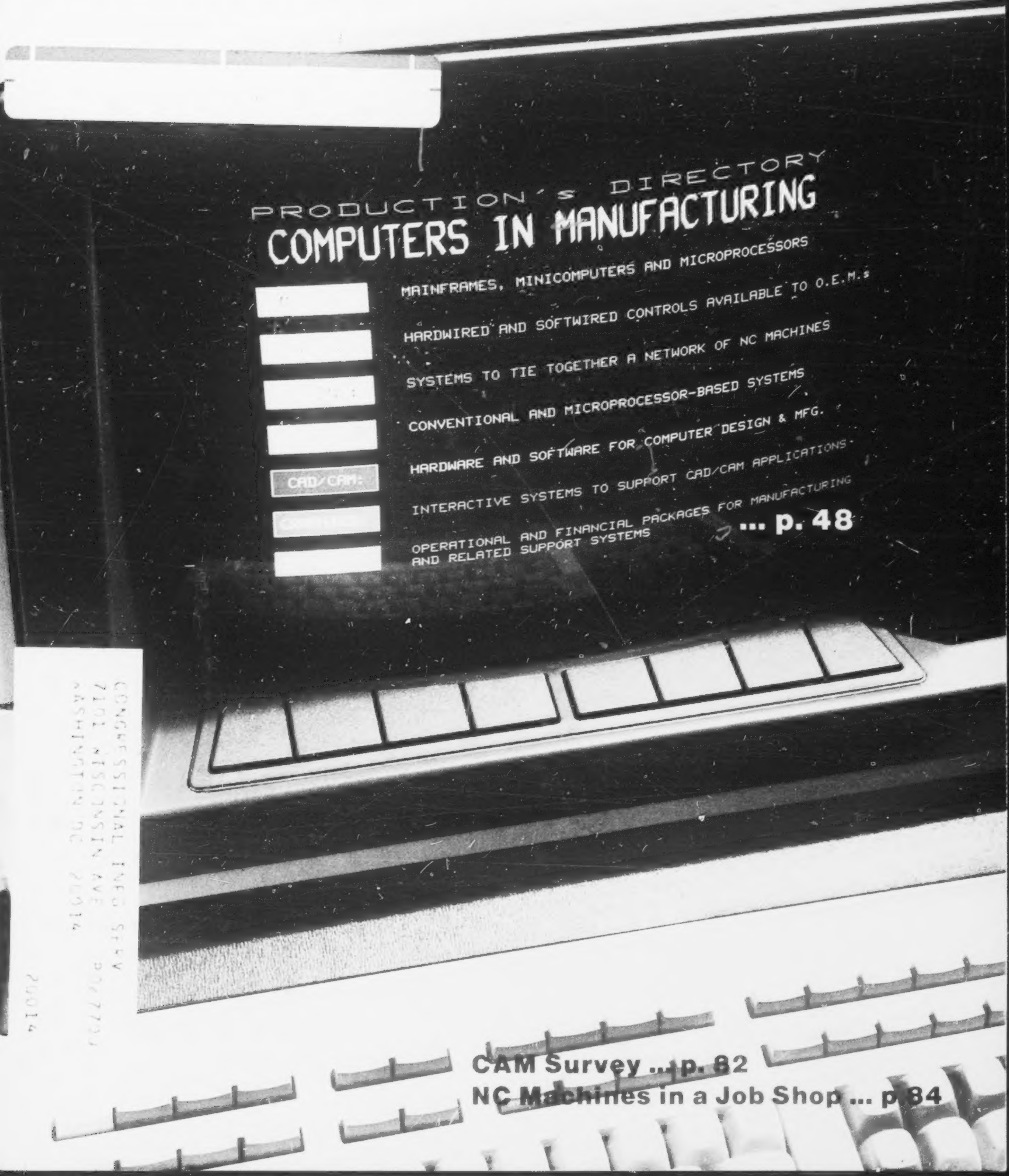

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MAINFRAMES, MINICOMPUTERS AND MICROPROCESSORS

HARDWIRED AND SOFTWIRED CONTROLS AVAILABLE TO O.E.M.s

SYSTEMS TO TIE TOGETHER A NETWORK OF NC MACHINES

CONVENTIONAL AND MICROPROCESSOR-BASED SYSTEMS

HARDWARE AND SOFTWARE FOR COMPUTER DESIGN & MFG.

CAD/CAM: INTERACTIVE SYSTEMS TO SUPPORT CAD/CAM APPLICATIONS

OPERATIONAL AND FINANCIAL PACKAGES FOR MANUFACTURING AND RELATED SUPPORT SYSTEMS

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PRODUCTION®

December 1980
Vol. 86 No. 6

It is the purpose of **PRODUCTION** to recognize and to fulfill the special needs of the managers and engineers who are responsible for improving manufacturing efficiency, costs and quality in production metalworking plants, and selected supplier industries.

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Computers—180 Places To Go for Help
PRODUCTION's third annual Directory of Computers in Manufacturing focuses sharply on computers and computer-based controls and their software that are specifically dedicated to the needs of production plants

Attitudes, Needs, Problems of CAM
A survey of 2000 plants turns up both problems and promises in applying computers to manufacturing. Lack of standardization and lack of understanding of detailed needs are major complaints

NC Machines Increase Shop's Capacity, Capability
In a job shop, G & H Production Mfg., Inc., seven NC turning machines and three machining centers are doing more and better work than 60 conventional machine tools. The company's experience dates back to 1973

From Supermarket to Super Shop
The president of Delphos Machine & Tool Co. is a strong believer in CNC in preference to NC. Problems with tape and faster, more reliable machine operation are his reasons

Airframe Machining Productivity Soars
Super CNC spar mills representing state-of-the-art machining and fixturing technology provide an 800 percent productivity increase in producing Boeing's wing components. A next step may be linkage with CAD

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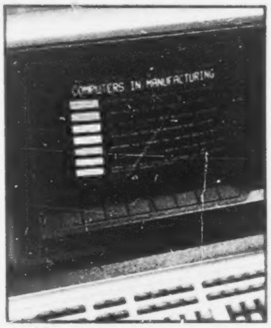

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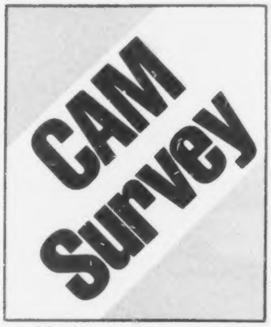

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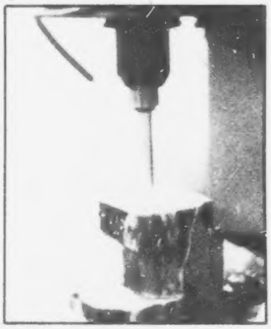

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Next Month: Domestic automakers' manufacturing operations shift gears to meet the challenges of the '80s

Published by Bramson Publishing Co., Box 101, Bloomfield Hills, Michigan 48013 (313) 647-8400

A survey of 2000 plants turns up both problems and promises in applying computers to manufacturing. Here are comments and results

Survey Reveals CAM Attitudes, Needs, Problems

"As users, we do not fully understand what we expect from computers. We set limits before we fully understand. As we progress, we spot capabilities previously not known by us. We then require changes because the original goal changes.

"Some day we will fully understand what we really require, and we'll be able to specify how we can get there."

That's the way a manufacturing engineer for an eastern aircraft company summed up what seems to be a consensus about the problems of getting computers into manufacturing. The two basic problems cited most frequently in a PRODUCTION random survey of 2000 plants have to do with, first, a lack of in-house knowledge and understanding about computer-aided manufacturing, and, second, a lack of standardization of systems and of software.

These are probably no new messages for either users or suppliers of Computer-Aided Manufacturing (CAM) systems, the survey does, however, confirm that the major inhibitors to greater application of CAM in metalworking has more to do with understanding than with technology. Just a year ago, in our special PRODUCTION Round Table article on computers, Frank Curtin, group vice president, Machine Tools, Cincinnati Milacron, Cincinnati, commented: "Why aren't computers being used more in manufacturing? The technology exists, but we lack the skilled people to implement the systems and to make them work. Every company has a real shortage of computer application engineers. The tools are there, but we haven't been smart enough to put them all together."

> **"We need very few more 'Star Wars' developments. What we would like from suppliers is more standardization."**

In another PRODUCTION Round Table discussion in August, James F. Lardner, vice president, Deere & Co., Moline, IL, talked about the need for standardization as he commented on machine tool productivity. "Equipment uptime is becoming more and more important. Most of us who work with these problems at Deere feel that we need very few more 'Star Wars' developments. What we would like from suppliers is more standardization. We want machine tool languages we don't have to translate. We want standardization of controls so we don't have to carry 160,000 different electronic components to service the various controls we have at one of our large factories. We want a great deal more standardization of software interfaces."

In the current survey, a respondent from a New York company that has applied computers for every queried application except environmental control made a single comment with regard to problems with computers: "We continue to have problems with interactions between systems."

Payoffs. Nonetheless, computers are paying off for the survey respondents, and these users seem to be intent on solving whatever problems they encounter rather than avoiding them by steering clear of computers.

The benefits they checked are led by better control of work-in-process, followed closely by direct labor reductions—both big-ticket cost items where improvements through use of the computer can be dramatic. Only 55 percent indicated that they have an overall data base for their plant. Without such a data base, the marriage of systems or the joining of different facets of CAM is made more difficult.

Those respondents who have not yet applied computers had no single outstanding reason for not using computers (only 5 percent felt there was no discernible need), but nearly a quarter of them listed people problems (lack of time to apply or lack of in-house expertise) as the major reasons for not yet getting into computers.

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Despite the given reasons noted by some respondents for not getting into computers, CAM is a mushrooming activity in metalworking. PRODUCTION's annual Capital Spending Forecast shows that computer data systems for manufacturing will continue to be important capital investments through 1981 and 1982. □

PRODUCTION'S CAM SURVEY

1. Percentage of plants now using computers in:

Plant management and information systems (including scheduling, data collection, MRP, etc.)	89%
Direct machine (process) control (CNC, DNC, etc.)	63
Engineering support (including time study, line balancing, tool design, etc.)	53
Testing and inspection	41
Machine (process) monitoring	32
Environmental control	17

2. Area proven to be most effective.

Plant management and information systems	39%
Direct machine (process) control	35
Engineering support	14
Testing and inspection	11
Machine (process) monitoring	9
Environmental control	3

3. Major benefit of computers as they have been applied.

Better control of work in process	64%
Direct labor savings	59
Improved use of manpower	52
Better manufacturing flexibility	51
Improved machine utilization	49
Improved documentation/work measurement	48
Faster, better part programming	38

4. Major problem in implementing computers in manufacturing.

Lack of in-house computer knowledge	46%
Initial cost	27
Inability to verify adequate return on investment	25
Unavailability of appropriate software	24
Inadequate data base for computer operation	24
Inadequate training from the vendor	15
Hardware reliability	15

5. Among those who have not yet applied computers to manufacturing, these are the reasons most often cited:

Lack of staff time to engineer and apply computer systems	14%
Lack of in-house expertise required to apply computers	10
Not able to document justification	7
No discernible need (advantage) at this plant	5
Too costly	4
Do not have the data needed to feed the computer	3
Fear of computerization	2
Software not available for needs	2

NOTE

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January 1981

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Manufacturing PLANBOOK Supplement
Automation in Forming . . . p. 75

ROBOTS-Ready, Willing & Able . . . p. 89

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89 **Automaking Innovations May Alter Your Course, Too**
As the domestic auto industry shifts gears its new manufacturing facilities abound in state-of-the-art technological advancements. Many aim at improving quality while making the equipment more nearly foolproof. Examples from each domestic company are given

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If we are to utilize our metalcutting machine tools to their utmost, some say we'll be depending on sensors that tell us directly what's going on during the cut. If that's true, there's still some development work to be done

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An unexpectedly large number of manufacturing people—6500—thronged to the ROBOTS V conference and show in Dearborn, MI, where several new entries made their debut and preparations for putting them to work were discussed thoroughly

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Two new grades of CPM tool steels have been added by Crucible Specialty Metals Div., one for improved performance in high shock and wear conditions, the other as a way of avoiding the cobalt availability problem

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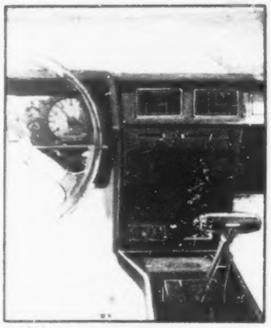

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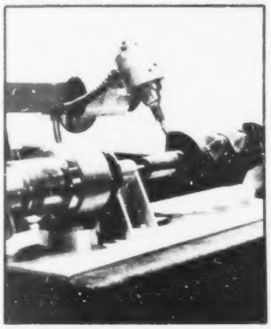

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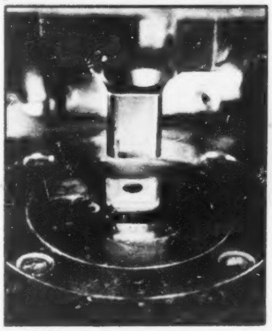

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Cover: As the automakers' future road unfolds, innovations for all of metalworking are coming. The illustrator is Mike Mikos.

Next Month: What Materials Requirements Planning (MRP) Can Do for You; Ultraprecision Results from Wire EDM's Marriage with a Computer

Published by Bramson Publishing Co., Box 101, Bloomfield Hills, Michigan 48013 (313) 647-8400

MANUFACTURING OUTLOOK

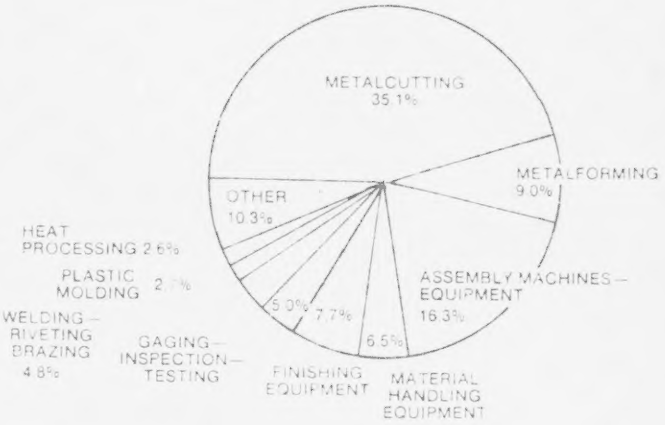
A distillation of fact and opinion based on regular contacts with leading economists and universities, and published data from The Federal Reserve, Department of Commerce, Council of Economic Advisors, The Conference Board and leading banking institutions.

Capital Spending Will Soften in 1981

Production metalworking industries* will spend about $11.0 billion this year for production machinery and equipment. This spending is at about the same dollar level as one year ago but translates into a decrease of 10 percent in real terms (1981 dollars). That's the projection based on the annual survey conducted by Bramson Publishing Company's Research Division in 12,000 plants which employ 50 or more persons. The survey was conducted in late July and August.

Spending intentions of respondents are less optimistic than one year ago with only 43.8% planning to increase their spending in 1981 (vs. 57.4% last year). Another 31.4% plan to spend the same amount as in 1980, 18.1% plan to cut back, and the remaining 6.6% were unable to answer the question. The indication is that many companies are in a "holding pattern" with respect to their machinery-equipment procurement programs.

HOW THE 1981 CAPITAL EQUIPMENT DOLLAR WILL BE SPENT



Color indicates increased proportions of category investment in 1981.

Highlights

- The primary reason to purchase equipment in 1981 is cost reduction with 64.6% of the respondents ranking this as a first or second reason to purchase. Need to increase machine capacity ranks second, falling from last year's number one spot; 43.8% cite it as primary for machinery-equipment purchase. The fact that capacity utilization had dropped to 76.1% at the time of the survey (August) from 84.2% the year earlier goes a long way toward explaining the decline in importance of this motive.
- The average minimum first year return-on-investment (pre-tax) in justifying new production equipment is 32%. While below the long-term trend of a 35% requirement, the number is up from 28% last year. It makes equipment justification more difficult and reflects the problem caused by decreased cash flows at industry's current lower operating rates.
- Numerically controlled machine investment continues to climb with 44.6% of the respondents reporting plans to purchase. Between 1976 and 1981, plants planning NC/CNC purchases grew 47% from the purchase intention rate of 30.4% in 1976 to the 44.6% for 1981. 47.7% of all respondents report they currently operate NC/CNC equipment.
- While about 90% of total expected equipment

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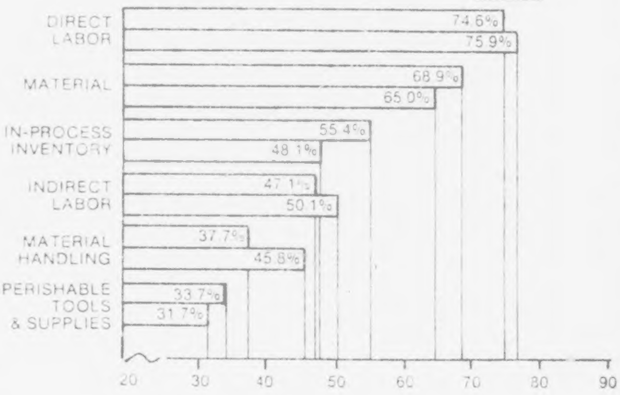
COST REDUCTION TARGETS



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*Considered for the purpose of this study to be plants reached by PRODUCTION Magazine in: Fabricated Metal Products (SIC 34); Machinery, except Electrical (SIC 35); Electrical Machinery (SIC 36); Transportation Equipment (SIC 37); Instruments (SIC 38); selected Miscellaneous Manufacturing Industries (SIC 39) and Metal Furniture (SIC 25) which employ 50 or more persons. The 1981 figures are projected from respondents from 12,000 plants contacted in late July and August, in keeping with past procedures.

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appropriations will be spent with domestic sources, it is interesting to note that 34% of total respondents plan to spend 1% or more with non-domestic sources. Of this group, they will, on average, spend 25% of their 1981 equipment dollar with these sources.

- 30.3% of the plants responding currently operate a portion of their production equipment or facility with computers or minicomputers. With planned installation of another 4.5% by plants in 1981 and 7.2% in 1982, we are projecting that 50% of the plants reached by PRODUCTION will operate a portion of their production equipment by computer or minicomputer by the end of 1983.

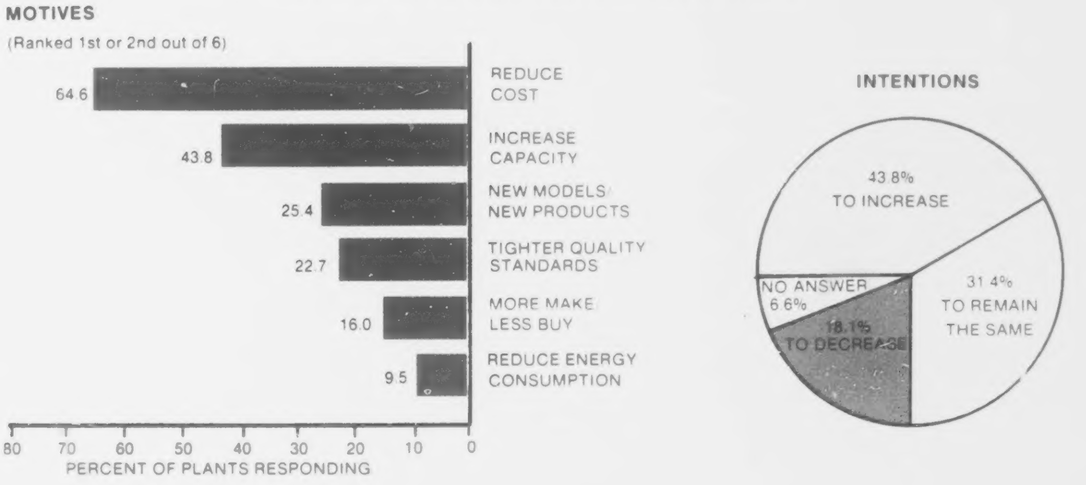
Patterns

In 1981, larger shares of the equipment dollar will go to metalcutting machines (up almost 4 percentage points from last year), assembly machines and equipment, and cleaning-finishing equipment. Smaller shares will go to metal forming machines (down to a 9.0% slice of the equipment pie), material handling, gaging-inspection-testing, welding-riveting-brazing, plastic molding, and heat processing equipment.

Detailed information on each category of equipment will be presented in PRODUCTION's Manufacturing PLANBOOK 1981-82 which will be published in mid-April 1981. □

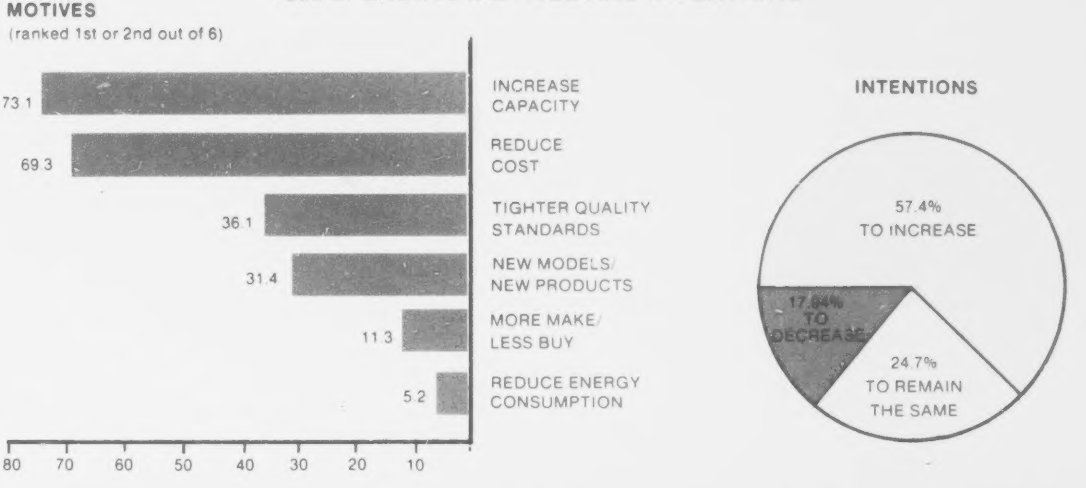
NOW

1981 SPENDING MOTIVES AND INTENTIONS



ONE YEAR AGO

1980 SPENDING MOTIVES AND INTENTIONS



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March 1981

PRODUCTION

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Does America Deserve A Black Eye For Quality? p.79

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Coated Abrasives: Fast Take Off . . . p.86

Machine Leasing Keeps Shop Up to Date . . . p.93

PRODUCTION®

March 1981
Vol. 87 No. 3

It is the purpose of **PRODUCTION** to recognize and to fulfill the special needs of the managers and engineers who are responsible for improving manufacturing efficiency, costs and quality in production metalworking plants, and selected supplier industries.

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In Part I of a two-part series, the status of America's product quality as seen by samples of PRODUCTION's readers and the public at large is investigated.

[illegible] **Abrasive Belt Machining—Fast Take Off**
High metal removal rates with high machine uptime are important benefits of the advances in this process' systems and technology.

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Nineteen leased CNC machines, plus high-quality performance, plus motivated people are the basis of the solid growth being registered by Wyndham Industries, Inc.

[illegible] **With Faucets, It's What's Underneath That Counts**
Polishing and buffing operations got high priority when Masco Corp.'s Delta Faucet Div. equipped a new plant. Several new Acme machines do the job.

101 **Mercury Marine Boosts NDT Production 50%**
Two specially designed Magnaflux magnetic particle inspection units provide efficiency gains in checking for defects in crankshafts and propeller shafts.

[illegible] **Shift to Welded Tubing Cuts Steel Cost 15%**
By switching from seamless to drawn-over-mandrel steel tubing, Jameson Corp. has lowered manufacturing costs from those of four years ago.

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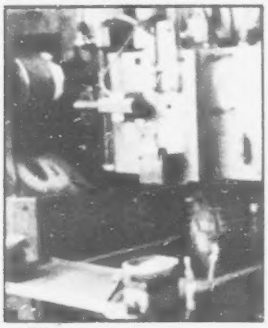

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Cover: This familiar "face" takes some beatings on quality.

Next Month: New cutting tool geometries.

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Quality — Part 1

Does America Deserve A Black Eye for Quality?

A sure-fire way to start a lively argument is to make a flat statement about the quality of American products. It doesn't matter which position you take—you can hold either that they're lousy or totally superior; you'll find a goodly number of people with the opposite viewpoint, and with strong evidence for their opinion.

America's manufacturing industries are being seriously challenged from abroad and product quality has become a major battleground. At stake, in the view of many manufacturing people, is nothing less than survival.

Attesting to the importance PRODUCTION's readers attach to the subject was the immediate and extremely high response to a confidential questionnaire that reached the desks of 1300 randomly selected readers during the Christmas/New Year holidays. Our mailbags literally bulged with their prompt replies.

The candor that was expressed and the comments they added seem to signify the depth of feeling about the importance of the subject of quality and their desire to wave storm warning flags. For example, 80 percent of the respondents admitted that their companies have shipped products of sub-standard quality; in many cases, they said, this was done at the express direction of a company executive.

There are many surprises, both pleasant and unpleasant, in this survey.

- One is that American quality is probably better than it is often perceived to be.
- Another is that America's production workers do "give a damn."
- A third one is that companies currently hurting for sales nevertheless are letting poor quality products reach their customers.
- A fourth is that efforts at quality improvement are being made but there appears to be considerably less than a maximum corporate commitment to that objective.

If we had to fill out a report card on American product quality, we'd be hard-put to grade it more than "B-"—well above "passing" but certainly nothing to brag about.

Uncle Sam doesn't deserve his black eye. But he's far from being in fighting trim if he's expecting to do battle with some heavyweights.

In this two-part series, we'll look first at the quality situation as it is seen to exist by observers and by people on the actual firing line. Next month, we'll report on the constructive actions now being taken by numerous members of American industry.

The situation permits no complacency; the warnings are clear. But so, thankfully, are the solutions.

(continued)

A recent survey by the American Society for Quality Control of 10,000 American households showed overwhelmingly (72.6%) that the American public considers American industry to be more concerned with profits than it is with product quality.

A survey by PRODUCTION of 1300 picked-at-random readers shows just as clearly that expediency takes precedence over quality in many American plants.

Poor quality products are going off the shipping docks of American companies; our readers are seeing it happen. And in some cases being told to make it happen.

Also, at their receiving docks, respondents almost universally report poor quality of incoming materials and equipment.

P.T. Barnum said: "There's a sucker born every minute!" An anonymous sales genius said: "The customer's always right!"

Today, in many instances, the customer finds he or she is not right. But they're not about to be dubbed as suckers. The so-called "fickle" customer may be showing instead that he's finicky (see Losers and Winners below).

As crucial to our industry's survival as its ability to operate more productively is its ability—and commitment—to make products of higher quality.

The domestic automotive industry realizes this more clearly than any other, because it has had the lesson brought home to it more painfully.

No industry, however, is immune to the danger nor so superior as to be able to risk letting down its guard.

We know our readers have a better understanding of what quality is than the public at large. And we consider these readers more sophisticated and critical. The comparison of ASQC's survey results and PRODUCTION's regarding the relative perceived quality of American products and imported products, therefore, adds credence to the importance of the danger.

Three quarters (75.7%) of the public feel that the quality of foreign products is better than (27.4%) or the same as (48.3%) that of American products. Eighty-eight percent of the respondents to PRODUCTION's survey rank foreign **consumer** products better in quality than (25.3%) or equal to (62.7%) domestic products.

Industrial products of American origin, however, fare much better in the experience of our readers. Sixty-five percent of our respondents rank quality of the foreign output equal to (47.0%) or better (18.1%). The American industrial products are rated superior by 34.9 percent.

Our readers have a very different view than ASQC's sample of what's been happening to American quality and where it's going in the future.

In ASQC's survey, almost half of the public (49.9%) feel that product quality has dropped during the past five years. A fourth (24.8%) believe it has remained the same, and a fourth (25.3%) see an improvement.

The public's majority expectation is that product quality in the next five years will stay at today's lower level (35.7%) or will decline further (23.6%). The group looking for improvement (40.6%) is, significantly, composed largely of persons over 50. The segment of the population that is most negative as far as quality improvement is concerned is the age group of 25-to-49-year-olds—the major buying group. The attitude about future American product quality becomes more negative as education level and income level increase.

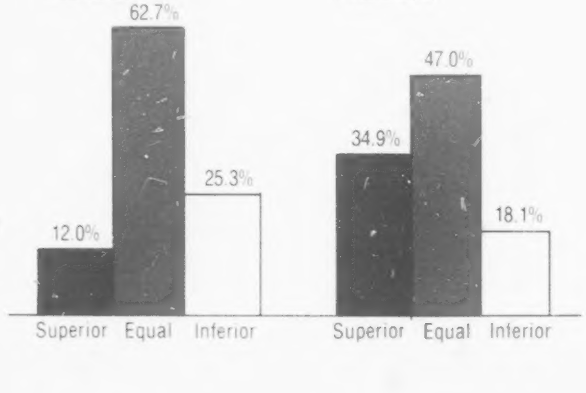
In contrast, a majority of PRODUCTION's reader sample (55.1%) says the quality trend has been better in the last five years. Only 17.3 percent say it has deteriorated.

The PRODUCTION sample is much more sanguine than the public at large about the future: 80.2 percent expect the quality trend in the next two years to improve; only 5.9 percent look for a decline and 13.8 percent expect it to remain the same.

This group sees and in many cases is directly involved in the concrete actions for improvement being taken by their companies. More than a few of them express the conviction that the quality trend has to improve.

Real or Phony? If American quality actually has improved and is going to get even better, the tone of this

How Do American Products Compare with Foreign Products?



article should be more optimistic than it is.

However, the response we got to a question about quality philosophy in our readers' companies is sobering.

Our question was: "Most companies have a stated philosophy about quality. In companies where you have worked, is this a sincere objective backed up by adequate personnel, equipment, training, rewards/punishments? Or is it mostly 'lip service'?"

The percentage replying "lip service" was 43.5. Their write-in comments about the adequacy of personnel, training, reward/punishments were often caustic.

Among that small majority (56.5%) who said quality is a sincere objective in their companies there were also many emphatic comments added.

There seems to be nothing "gray" about a company's attitude on quality. They either are getting production to their quality standards, no ifs, ands, or buts, or they're proving by their laxness and low priority to it that it isn't very important.

Conventional wisdom says that this latter condition is the fault of the workers—their purported "don't give a damn" attitude. Reflecting this, only 35 percent of the public, as shown in the ASQC survey, feel that American workers are concerned about the quality of the products they make or the services they render.

Our survey shows, however, that the quality problem isn't a worker problem, at least not very often.

Our readers were asked to characterize "the average production worker at your company with respect to workmanship."

More than twice as many respondents (11.6%) said this worker "is highly quality-conscious and takes pride in good work" than said "doesn't give a damn" (5.5%).

A substantial majority (60.0%) said this worker "is usually conscientious and 'tries to do it right.' "

The remaining 22.8 percent characterized the average worker as "produces well when watched but otherwise slacks off."

Expediency Rules. The message we get from these statistics is that in most cases a company's management dictates what quality performance its products will achieve. The workers get most of their signals from the top-level attitudes and actions they observe. Concern for quality is a contagious "disease."

It's been said that "companies get the unions they deserve." It certainly seems to be true that "they get

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Losers and Winners

To nobody's surprise, 36.5 percent of the people responding to an American Society for Quality Control 10,000-household survey on American product quality rated automobiles low. American vehicles, likewise, were the clear-cut choice among PRODUCTION's surveyed readers who had bought for personal use in the last two years a mechanical product whose quality, in their judgment, was "lousy." Cars, trucks and vans captured 30.6 percent of their "yes" votes.

Household appliances took second billing, at 15.3 percent of mentions for "lousy" quality in our survey, while portable power tools ranked third at 5.5 percent.

However, less than half of PRODUCTION'S survey respondents (49.7%) have been stung by a poor quality consumer product. A slim majority (50.3%) has had no unpleasant personal purchase experience in the past two years.

In the other direction on the quality scale, the ASQC survey has 39.1 percent of the public ranking the quality of appliances high, toys at 32.5 percent, and autos getting a high score from 17.6 percent. Drugs and pharmaceuticals were rated high or very high in ASQC's survey by 67.3 percent of the public. Frozen foods came in for a 58.1 percent high or very high mark and television sets were ranked high in quality by 50 percent of the survey responders.

While American industrial equipment was ranked superior to that made abroad by 34.9 percent of PRODUCTION's survey respondents compared with the 18.1 percent who ranked it inferior, the quality of raw and semifinished materials bought for use in production operations came in for heavy criticism.

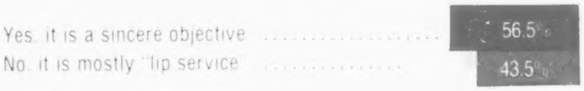
Steel, castings and molded plastic parts were the most frequently mentioned items in part 2 of our survey's question: "Has your company had quality problems in the past year with purchased equipment, materials, supplies, etc.? What product(s)?"

An overwhelming 74 percent of the respondents said "yes" to this question before enumerating the faulty items and indicating in most cases that these had failed to meet specifications.

Not infrequently, the write-in answer for the subsequent question on "What remedial action was taken?" was: "We changed sources," or, often in the case of plastic items, "We're now making them ourself."

In a year of slow demand, what, if anything, were those experiences telling the responsible suppliers? ☐

Companies' Dedication to Quality — Is It Sincere or 'Window Dressing'?



the quality they deserve."

This view is reinforced by the comments made in answer to our two-part question: "Do you think a product of sub-standard quality has ever left your company's shipping dock? If you answered 'yes,' why do you think this happened?"

Eighty percent of our respondents said "yes." The primary reasons written in were "end-of-month crunch," "to meet shipping schedule," and "order from Sales to ship." Far less prevalent were such explanations as "oversight," "inadvertent error," "inadequate final inspection personnel," "we use statistical product checks."

The public's belief as shown in the ASQC results that American industry is more interested in profits than quality gets some limited support from PRODUCTION's survey, although our study singled out cost reduction rather than profit generation for research.

We asked: "In your organization, how does quality improvement rank as an objective compared with cost reduction?"

Encouragingly, almost half of the respondents (46.7%) said there is "strong emphasis on both."

Not surprisingly in the closing month of depressed 1980, 35.0 percent of our sample said there is "more emphasis on cost reduction." Almost half as large a segment (18.2%) indicated there is "more emphasis on quality improvement."

We pursued the cost reduction issue vis a vis the quality improvement issue further, asking those readers who said cost reduction currently is receiving more emphasis whether in the past quality had ever taken precedence.

"Yes," said 68.1 percent of them. This had happened, they explained, because of "a product 'disaster' " (39.3%), "an executive's edict" (33.9%), or "a competitor's advantage" (26.8%).

Not an 'Either, Or' Choice. It is worth emphasizing, as several of our readers did and as ASQC President Jay W. Leek does in his "Quality Improvement Manifesto" (below), that the objectives of cost reduction and quality improvement are not mutually exclusive.

Improvement of quality, rather than being a source of expense, can be an important contributor to cost

A Quality Improvement Manifesto

by
Jay W. Leek
President, American Society for Quality Control*

For years, American business and industry has been fighting the effects of inflation, increasing foreign competition, consumer attitudes, government and a host of other perceived adversaries. Unfortunately, most observers agree that we have lost more of those battles than we have won. The net effect of those losses has accumulated over the years to the point where it now appears that the United States is in the first stage of a crucial battle that may well determine if this country will emerge from the 1980s as the dominant economic power in the Western World.

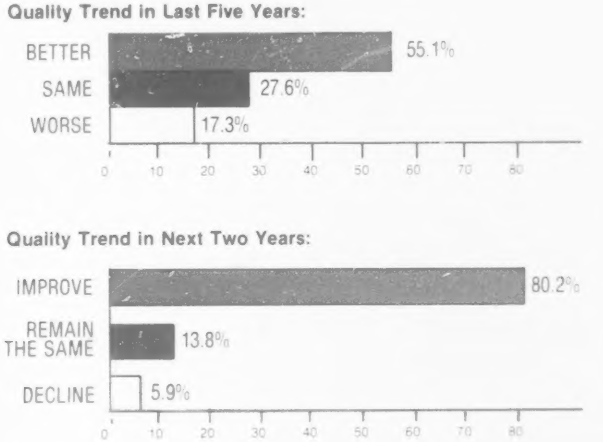
If that seems like another doomsday prediction or a serious overstatement of the actual situation, consider the impact of foreign competition in both domestic and foreign markets.

As our experience with the American automobile industry clearly shows, whether or not we win the battle depends on holding the confidence of the American consumer. And here is where we are in the greatest jeopardy.

We are caught up in an entirely new attitude toward buying goods and services that was born in the consumer movement and fed by inflation and today's uncertain economy. Consumers now demand goods and services which do what they are supposed to do the first time, every time.

**Mr. Leek also is affiliated with The Quality College, Inc., Winter Park, FL*

What Direction Is Quality Going?



reduction. Leek says the cost of poor quality is, on the average, 10 to 15 percent of a company's sales dollar.

It might be revealing to those companies where defective products have knowingly been shipped under the edict of "ship it now, fix it later" if they were to analyze a make-it-right-the-first-time cost against the worth of the on-time delivery and the subsequent repair cost and customer's ill-will.

The public, however, has come to believe that product price and product quality are closely linked. Half of ASQC's survey respondents (49.7%) agree that in today's economy making a high-quality product just simply costs too much. Women, in general, feel this way more than men. But as income and educational levels increase in ASQC's sample, the alibi about the high cost of quality for today's economy becomes less accepted.

The Solution Isn't Just P.R. The American Society for Quality Control is in the process of launching a multi-faceted campaign that has as one of its objectives to improve the public's perception of the quality of American products.

It will be asking companies to help convey the quality message to their publics.

It also is seeking a national commitment to the improvement of quality.

These commendable efforts must not be allowed to have a hollow ring. What counts in the long pull is an actual improvement in quality—the kind of turnaround the Japanese were able to accomplish in the

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In short, consumers want quality and they are willing to pay more for goods and services they feel confident will deliver that quality. Planned obsolescence is obsolete.

Sensing that this attitude was developing, the American Society for Quality Control commissioned the first and most comprehensive study of American consumer attitudes toward quality.

The results show that nearly half the population feels that American product quality has declined over the past five years, and, more important, more people—nearly 60 percent—feel that product quality will stay at that same low level or continue to decline over the next five years.

The vast majority, and particularly the better paid, better educated, sent a clear message. They have lost confidence in the ability of American manufacturers to provide superior products.

We do not believe that this is the case. We know that the overall quality of American products is superior to any country in the world. But whether what people believe is accurate or not is almost beside the point. People act on what they believe to be true and their perception is that American suppliers are delivering second rate goods and services.

And here is where perception and reality come together. The American people are not sure what part labor and the economy play in declining quality, but they have no doubts about the responsibility of business and industry. In one of its most telling findings, the study shows that nearly 75 percent of the American public emphatically feels that U.S. industry is more concerned with profits than it is with quality.

We know that one response to increasing costs over the past 10 to 20 years has been to shave quality in favor of short-term profits. We have let our plants and equipment become outdated, substituted materials that were *almost* as good as the original materials, and clung to the assumption that the sheer weight of the American industrial machine could overcome any competition.

That may have been true in the first half of the century when we were the industrial capital of the world and the predominant source of its growing demand for goods and services. But the emergence of

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1950s when a national policy toward improvement of quality as a means of winning export markets was broadly and successfully implemented.

Nature of the Efforts. We at PRODUCTION can report that the process of quality improvement is well under way in many of the companies we've contacted.

The re-dedication of the automotive industry to quality is perhaps the most notable example. We'll report more fully on it next month. And nearly every company we've contacted in other industries is extremely conscious of the need to expand their quality assurance efforts and most have embarked, in a variety of ways, on that path.

In our survey, only 7.8 percent of the respondents said their companies are not taking any kind of quality improvement measures. A few of these, however, indicated that some actions are being considered.

Suggesting that the actions in the vast majority of companies are not either superficial nor minimal is the current emphasis on product design changes.

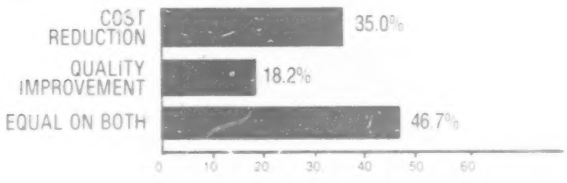
Our respondents were asked to identify which of the following quality improvement actions their companies are taking: Product design changes; new gaging/inspection equipment; new production equipment; employee training/motivation programs; other.

In this listing, product design changes lead (71.1%). Employee training/motivation programs are close behind in mentions at 70.0 percent.

New gaging/inspection equipment has been or is being installed by 64.8 percent of the companies that are taking quality improvement actions, and 62.7 percent of such companies report they are adding production equipment with better quality capability.

Structural changes in the organization responsible for quality assurance/quality control were pointed out by several of our respondents. These range from having Quality Assurance now report directly to the president to moving the quality responsibility largely to the production workers. In this connection, Quality Circles are reportedly in use or being instituted at 28.4 percent of the respondent companies.

Where's the Strongest Emphasis?



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A Quality Improvement Manifesto

highly skilled managers overseas with modern plants and equipment dramatically changed our position.

In short, we drastically overestimated the willingness of the American people to buy anything we put on the market while we underestimated the competitive forces that were developing overseas.

We are now paying the price.

So what do we do about it?

- **First, we have to recognize that we have a critical problem.** That may seem obvious, but there are still too many of us who try to explain away the situation by pointing fingers at the economy, labor, government, and other "factors," rather than recognizing that the solutions start with us, not them.
- **Second, "Us" starts with the chief executive officer and top management being involved in assessing what poor quality practices are actually costing their organizations.** Too few members of top management recognize that poor quality may well be costing them an average of 10 to 15 percent—and as high as 20 percent—of their sales dollar.

A reduction in quality costs of only 1 percent in a one-hundred-million-dollar corporation would yield an additional $1 million in "found" money to use on capital equipment, personnel training, or to add to the profit side of a P&L statement.

- **Third, we have to recognize that older concepts of "quality control" are out of date.** A good deal has been learned about quality as a comprehensive management tool that can be employed at every step from design through assessing how well goods and services stand up to buyers' demands.

In fact, experience has shown that the kind of improvements we have been talking about can only result through introduction of comprehensive quality management directly supported by a chief executive officer.

- **Fourth, we need to limit the traditional adversarial relationships that have existed between business, labor, government and consumers.** Labor and management in the American automobile industry, for example, are evolving new relationships to meet their common need to produce higher quality automobiles capable of competing with the Japanese. Other industries have experimented with ways to involve workers in the production of goods and services and have found as much as a six-to-one return on their investment.

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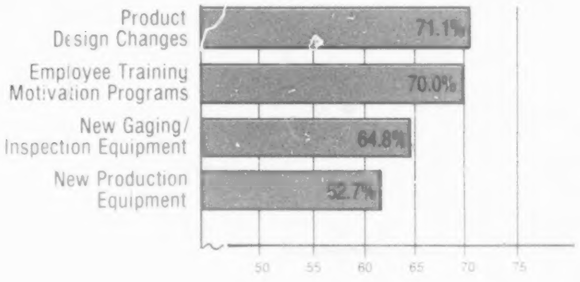
What Quality Improvement Actions Are Companies Taking?



While a few people said their outgoing product inspection is being intensified, a far greater number said the emphasis now is on in-process audits—catching and correcting defects before the products are totally built. The preventive theme, of course, is heavily mentioned in connection with the current emphasis on new product design. Where personnel problems have been great, product design for process automation is sometimes seen as the basic solution.

In the category of "other" types of company actions being taken for quality improvement, the most significant ones pertain to top-to-bottom quality dedication. This was exemplified by this comment from a manufacturing engineer at a home appliance company: "Our name means quality. The attitude in the plant is that the company would rather go under than cheapen its product."

Obviously, the respondents who indicated that this or a variation of it is the prevailing posture at their organizations are not among the 43.5 percent who said they see more "lip service" to quality than dedication to it.

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The future reputation and acceptance of our products in domestic and international marketplaces will importantly hinge upon whether this two-fifths plus of the American companies represented in PRODUCTION's survey sample change their quality philosophy.

We'll give them models to follow next month.
Howard C. Tuttle ☐

- **Fifth, organizations need to communicate their quality efforts to their own publics.** While in no way minimizing our quality problems, we do a better job of producing goods and services than is generally recognized. Part of the problem is that the situation is seen as being worse than it actually is. Realistic communication of an organization's quality efforts will help to bring public perception and reality closer together.
- **Sixth, government can assist our national effort by changing such things as depreciation schedules, investment tax credits, new incentives for personal savings, and by recognizing that industry members need the latitude to develop joint activities without automatically falling prey to anti-trust actions.** We need to strike a new, supportive relationship between government and business to counter the support other governments provide their manufacturers.
- **Seventh, labor organizations need to actively promote a sense of pride and craftsmanship in their members and be willing to take part in mutual management-labor efforts to improve quality and productivity.** Both parties have a fundamental stake in assuring that American organizations remain in business.
- **Eighth, and not last, we need to develop a common understanding of what "quality" means.** It means conformance to standards, not glitter and gloss. In that sense, the difference between a Volkswagen and a Cadillac is luxury, not quality. The quality of the two cars—their performance for value paid—should be the same. They both should conform to the standards set for them. We need to educate both people in business and the general public to what quality means.

The American Society for Quality Control has recognized the need for leadership and coordination in the development of a national commitment to quality in this country.

Over the past 35 years, the 37,000 members of ASQC have learned a good deal about quality and the management of quality in business and industry. We are now making a concerted effort to make that information available and to extend the Society's educational efforts.

For our part, the American Society for Quality Control is committed to making sure that the competitive battle of the 1980s is resolved in this country's favor. ☐

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PRODUCTION's

Manufacturing PLANBOOK

1981-82

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- How to Plan:
  - —Production Plants
  - —Contract Job Shops
- Planning for Productivity:
  - —Whose Job Is It . . . How Do You Measure Results?
- Improving Productivity in Small Shops
- Quality-of-Work-Life and Manpower Planning
- Planning for MRP . . . and Odd Lot Production
- PLUS: Capital Spending Outlook . . . Technology Update . . . Buyers' Index

PRODUCTION's
Manufacturing PLANBOOK 1981-82

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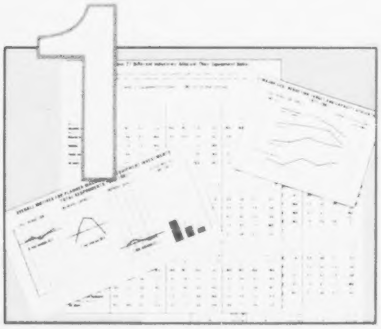
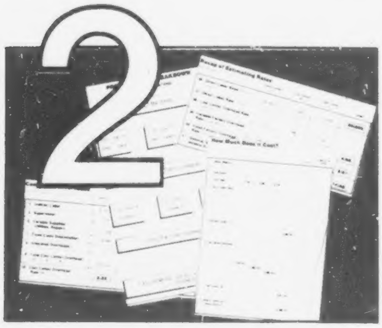


Outlook/Trends...p.9

Nine pages of charts and tables reveal 1981-82 spending plans and trends allowing you to compare your investment programs with others in your industry. Details on cost reduction targets . . . reasons for spending . . . five year trend tables showing investment patterns by industry . . . allocations for NC/CNC, flexible machining systems and computer control . . . industry spending patterns by machine/equipment categories . . . and more.



How to Plan...p. 43

Practical procedures and tools to help you do a better job of planning. Covers planning to allow for flexibility to meet changing industry needs . . . profitability planning for job shops . . . whether you should consider MRP . . . how to exploit opportunities offered through technology transfer . . . how to plan optimum run quantities for non-repetitive operations . . . improving productivity . . . the developing involvement of Quality of Work Life and manpower planning.

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Update...p. 97

Update provides more than 000 write-ups on current developments, new machines, tools, equipment and materials. Items are brief and have been arranged by category and then grouped into subsections for your ready reference. Categories include: Assembly . . . cleaning/finishing . . . gaging/inspection/testing . . . heat processing . . . joining . . . materials . . . metalforming . . . metal removal . . . plastic molding/forming . . . process and machine control . . . robots.

Buyers' Index...p. 197

Every editorial and advertised item has been organized by category to help you locate the source quickly. The company name, address and editorial/advertising reference is located under the appropriate process, material or equipment category: Assembly . . . finishing . . . gaging/inspection/testing . . heat processing . . . joining . . . materials . . . metalforming . . . metal removal . . . plastic molding/forming . . . process and machine control . . . robots. Everything presented in this workbook.

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1

Outlook/ Trends

How do your capital spending outlays compare with others in your industry? What are your cost targets? Reasons for spending? Nine pages of charts and tables reveal spending plans and directions to help you answer these questions. They should help you take measure of your manufacturing position.

10 **Highlights and Survey Scope**

11 **Relationship of Cost Reduction Targets and Capacity Utilization**

11 **Motives for Capital Investment**

13 **Numerical Control, Flexible Machining and Computer Trends**

15 **How 27 Industries Allocate Their Equipment Dollars**

24 **Industry Spending Patterns By Equipment Category**

Capital Spending
1981

An Outlook which allows you to:

- Note changing trends and objectives in machinery/equipment purchase and use
- Compare your machinery/equipment investment with others in your industry

In the fall of 1980, the Research Division of Bramson Publishing Co. surveyed the 1981 capital spending plans for machinery/equipment in the metalworking market.* Findings indicate how funds will be invested and reasons for spending. Data are provided in charts and tables which should help allow you to determine your plant's competitive manufacturing capability in terms of other plants in your specific industry as well as metalworking manufacturing plants generally.

In the broadest sense . . .
You're typical if your plant is planning to apportion its investment for machinery and equipment as depicted by the following table:

	Percent of Investment 1981	Percent Deviation 1981 from 5-Year Average
Metalcutting machine tools	35.1%	+ 8.7%
Assembly machines/equipment	16.3%	+ 7.2%
Metalforming machine tools	9.0%	- 29.7%
Cleaning-finishing equipment	7.7%	+ 26.2%
Material handling	7.1%	- 8.5%
Gaging-inspection-testing	5.0%	- 12.3%
Weld-rivet-braze	4.8%	- 5.9%
Plastic mold-form equipment	2.7%	- 10.0%
Heat processing equipment	2.6%	+ 8.3%
Other	10.3%	+ 1.0%

You're also typical if in 1981 . . .

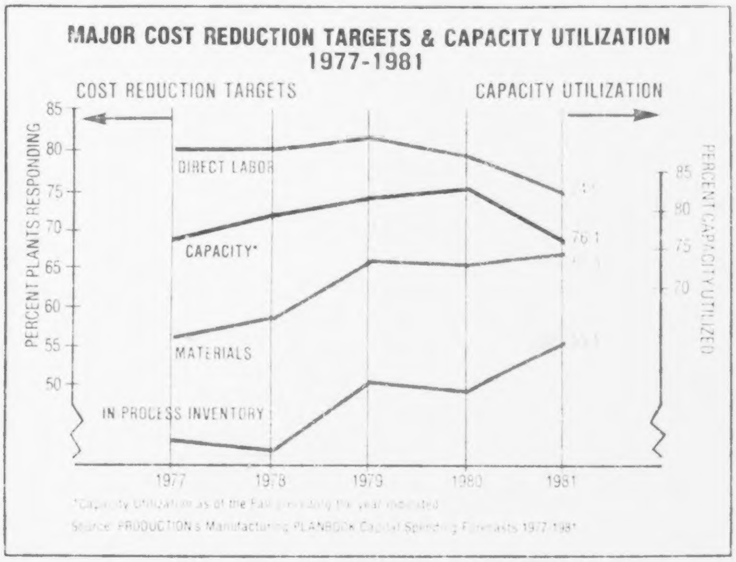
Your plant employs	and	Your machinery/equipment and expenditures are
50-90 persons		$ 174,000
100-499 persons		$ 368,000
500-999 persons		$ 699,000
1000 or more persons		$1,080,000

And . . .

- You were operating at 76.1% capacity utilization in the fall of 1980, down from 83.0% at the time of the survey the year previous. Interestingly, 60.2% of you plan to operate at a higher level and only 8.6% at a lower level this year;
- You'll source 11% of your total machinery/equipment purchases with foreign suppliers. Most of these dollars will be spent on metalcutting and metalforming machines;
- You expected to obtain approval for 84% of your submitted machinery/equipment budget and felt you would have it approved and in hand by early December;
- Your company requires a 32% first-year return-on-investment (pre-tax) in justifying new equipment, up from 28% one year ago;
- You will be allocating larger shares of the equipment dollar to metalcutting machines (up 4 percentage points from last year), assembly ma-

(continued)

***Survey scope:** *Plants reached by PRODUCTION Magazine and the Manufacturing PLANBOOK in: Fabricated Metal Products (SIC 34); Machinery, except Electrical (SIC 35); Electrical Machinery (SIC 36); Transportation Equipment (SIC 37); and Instruments (SIC 38) which employ 50 or more persons. 1981 figures are projected from respondents from 12,000 plants contacted in the survey in the fall of 1980, in keeping with past procedures. See January 1981 issue of PRODUCTION Magazine for other capital spending details not included in this presentation.*


MAJOR COST REDUCTION TARGETS & CAPACITY UTILIZATION 1977-1981

*Capacity Utilization as of the Fall preceding the year indicated

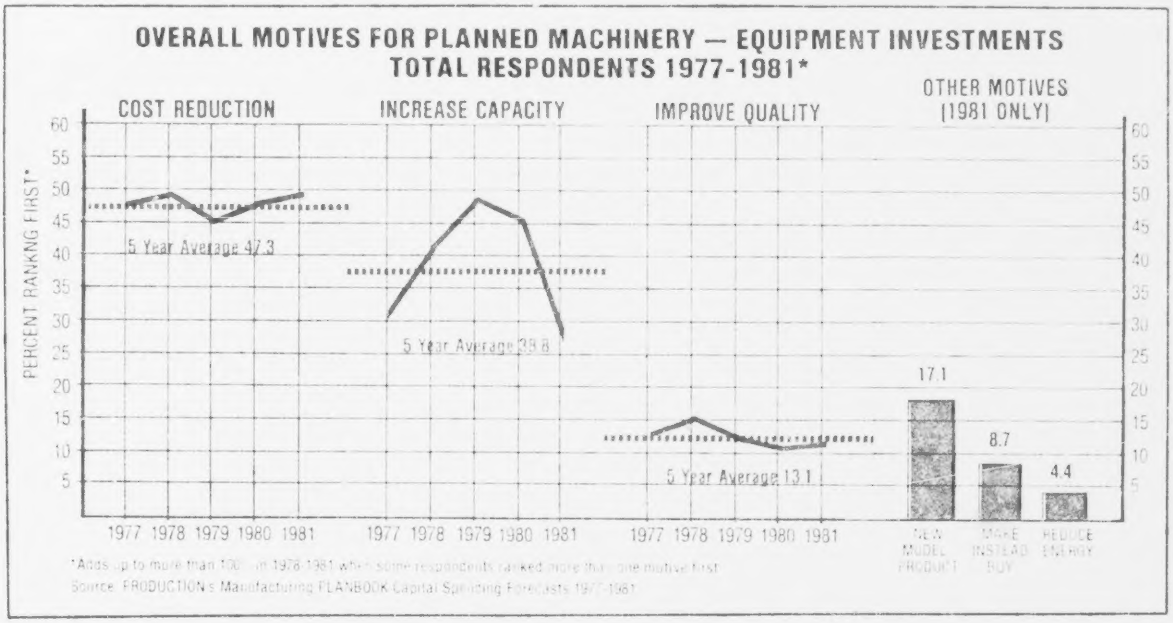
Source: PRODUCTION's Manufacturing PLANBOOK Capital Spending Forecasts 1977-1981

The Relationship of Cost Reduction Targets to Capacity

Direct Labor: Year in and out the number one target. Note decline of 5 percentage points since last year — the lowest it's been in 10 years. Contributing factors include: Increased attention by many of you to indirect labor, and the adjustments in direct labor already made as capacity fell. As capacity moves up, direct labor cost interest will lag for the first 6 to 12 months before picking up.

Materials: Heightened interest in materials utilization as a buffer to falling margins as capacity declines. Most interest evidenced for this cost reduction target since 1974.

In-Process Inventory: Big swing in interest as capacity falls and the 30% carrying charge for inventory rears its ugly head. Attention to in-process inventory always increases when sales declines force production cutbacks.


OVERALL MOTIVES FOR PLANNED MACHINERY — EQUIPMENT INVESTMENTS TOTAL RESPONDENTS 1977-1981*

*Adds up to more than 100% in 1978-1981 when some respondents ranked more than one motive first

Source: PRODUCTION's Manufacturing PLANBOOK Capital Spending Forecasts 1977-1981

Motives for Capital Equipment Investments

Cost Reductions: With the exception of 1979, the most important motive. Usually turns up when capacity requirements ease. Two out of three of you ranked cost reduction as the first or second reasons for investment.

Increase Capacity: Most of you report no squeeze in capacity requirements. Second big drop in two years after a steady climb. Lowest position in last five years falling 10 percentage points below the 5-year average.

Improve Quality: Continues as secondary motive to purchase capital equipment. This in spite of some industries whose products are faced with a "poor quality" image as perceived by many of their customers and prospects.

New Products/Models: The third most important motive for 1981 spending.

Make Instead of Buying: Always rises in importance when capacity utilization falls and you bring in work formerly contracted for on the outside.

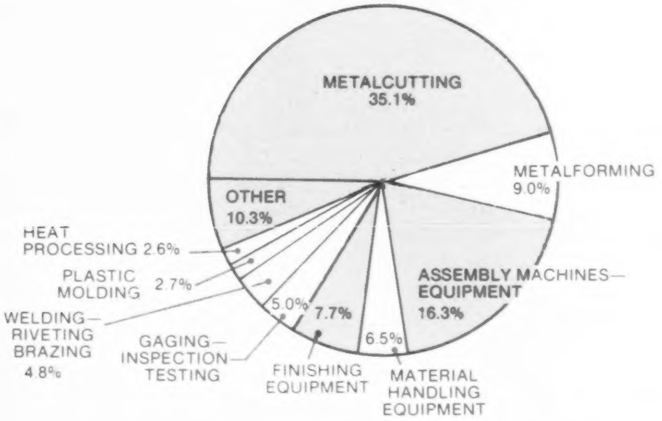
Reduce Energy Consumption: Only 4.4% of you ranked this as the primary motive. Gaining in importance as a factor affecting cost of operation and ability to produce due to energy availability.

chines and equipment, and cleaning-finishing equipment. Smaller shares will go to metalforming machines (down to a 9.0% slice of the equipment pie), material handling, gaging-inspection-testing, welding-riveting-brazing, plastic molding and heat processing equipment.

All in all . . .

You will spend $11.7 billion in 1981 for machinery/equipment (1981 dollars). This means a 10% drop in real spending. Three-quarters of you are planning to spend the same or more compared to one year ago (31.4% the same, 43.8% more). Only 18.1% plan to spend less. The remaining 6.6% of the respondents did not answer the question.

HOW THE 1981 CAPITAL EQUIPMENT DOLLAR WILL BE SPENT



Color indicates increased proportions of category investment in 1981.

Numerical Control

Numerically controlled equipment continues to take over more of your metalcutting, metalforming, gaging and assembly operations. Over the last five years, the number of plants reporting their purchase plans included NC or CNC equipment jumped from 34.4% in 1977 to 44.6% this year — a gain of almost 30%! At the time the survey was conducted, 47.7% of you reported your plant operated NC or CNC equipment. These plants account for 85.9% of all installations purchasing these machines.

Horizontal turning, horizontal and vertical machining centers and milling machines account for the majority of activity for the next three years. Here are the types of machines those plants intend to purchase with the year of purchase indicated:

Percent Intending To Purchase NC or CNC

	1981	1982	1983
Machining Center-Horizontal	21.6	16.3	9.0
Machining Center-Vertical	20.6	14.1	8.0
Boring	7.9	5.2	4.0
Drilling	13.3	10.5	5.2
Grinding	8.8	7.6	4.0
Milling	14.7	11.6	5.2
Turning-Horizontal	29.3	21.7	12.7
Turning-Vertical	5.9	5.9	4.6
Punching	9.5	7.1	5.5

Flexible Manufacturing Systems

They're past the curiosity stage. Almost 20% of total respondents report their plans include purchase of one type or another flexible system within the next three years. These systems run the gamut from machining centers on one hand through indexers, headchangers, multiple machining center systems, combination systems to multiple-station automatic systems with limited flexibility. Here are your reported plans for purchase:

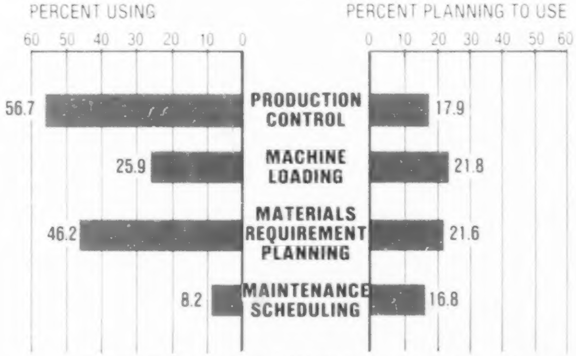
Will Buy Flexible Systems — Type and Timing

	1981	1982	1983
Flexible-Single Spindle	8.3%	6.2%	3.5%
Flexible-Multiple Spindle	4.9%	4.0%	2.9%

Computer Use

Last fall, 30.3% of you reported your plant operated a portion of your production equipment or facility with computers or minicomputers. Another 4.5% plan to in 1981; 7.2% in 1982. We are projecting half the plants we reach will operate a portion of their production equipment by computer or minicomputer by 1983.

USE OF COMPUTERIZED DATA SYSTEMS FOR



Source: PRODUCTION's Manufacturing PLANBOOK Capital Spending Forecast 1981

The use of computerized data systems has taken off as these management tools have enabled you to make better and faster decisions affecting manufacturing costs and profits.

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ALCOA

The charts on the next three right hand pages are provided to help you compare your capital investment directions with others in your industry.

They show spending allocations by industry for different kinds of production equipment. Allocations are shown in percentages so that you can develop data which is comparable.

The spending pattern is based on five years of investment — four previous and one forecast. This should even out year-by-year discrepancies between individual plants and an industry total.

How to Use the Charts

1. Find your industry. If you are not familiar with standard industrial classification numbers (SICs), look at the address label on the PLANBOOK cover. The four-digit number on line one above your name and title is the SIC number assigned to your plant. Use the first three numbers to locate your industry.
2. Obtain a percentage breakdown by category of your plant's capital equipment expenditures.
3. Compare your expenditures with spending patterns of your industry.
4. If your spending profile doesn't approximate your industry's, you should probably be asking questions why.

Here's How 27 Different Industries Allocate Their Equipment Dollar

Find your industry. Compare your capital spending patterns with others in your industry.
If your spending profile doesn't approximate your industry's, maybe you should be asking questions why. See page 14.

Trends in Equipment Purchases — 1981 to five year average

(Percent Total Expenditures)

	Cutlery, Hand Tools & Hardware (SIC 342)				Heating Equipment, Except Electric & Warm Air and Plumbing Fixtures (SIC 343)				Fabricated Structural Metal Products (SIC 344)			
	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average
Metalcutting machines	29.2	27.1	20.8	+ 30.3	25.2	18.9	19.8	4.5	15.7	13.7	13.0	+ 5.4
Assembly equipment	14.4	15.8	15.3	+ 3.3	10.0	17.2	14.6	+ 17.8	15.5	14.4	13.7	+ 5.1
Metalforming machines	19.3	16.1	15.7	+ 2.5	14.2	17.1	21.1	19.0	21.1	22.8	20.4	+ 11.8
Material handling equipment	7.8	7.2	6.9	+ 4.3	7.0	7.7	10.0	- 23.0	10.3	10.8	13.9	- 22.3
Cleaning/finishing equipment	9.3	10.8	11.1	- 2.7	7.0	9.3	8.0	+ 16.3	7.2	9.1	7.5	+ 21.3
Welding	3.5	3.0	4.3	- 30.2	6.1	8.7	5.7	+ 52.6	13.9	13.9	15.2	- 8.6
Gaging/Inspection/Testing	2.2	2.9	3.1	- 6.5	3.4	2.0	2.4	- 16.7	2.2	2.4	2.4	—
Plastic mold-form equipment	2.2	3.7	5.6	- 33.9	5.1	4.5	4.2	+ 7.1	0.4	0.3	1.2	- 75.0
Heat treating equipment	4.8	5.2	5.4	- 3.7	2.9	3.6	1.7	+111.8	4.0	1.9	2.0	- 5.0
All other	7.3	8.2	11.8	- 30.5	18.1	11.0	12.3	- 10.6	9.7	10.7	10.7	—

	Screw Machine Products, Fasteners (SIC 345)				Metal Forgings & Stampings (SIC 346)				Miscellaneous Fabricated Metal Products (SIC 349)			
	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average
Metalcutting machines	50.0	51.8	43.4	+ 19.4	15.8	15.6	14.8	+ 5.4	26.8	31.3	33.1	- 5.8
Assembly equipment	6.8	8.9	9.6	- 7.3	7.5	11.1	11.8	- 5.9	9.8	14.6	10.8	+ 35.2
Metalforming machines	20.1	16.4	15.1	+ 8.6	41.5	40.1	35.9	+ 11.7	14.8	13.0	15.0	- 13.3
Material handling equipment	3.7	3.7	6.9	- 46.4	8.6	6.9	9.5	- 27.4	7.0	6.4	7.4	- 13.5
Cleaning/finishing equipment	3.5	5.2	5.3	- 1.9	6.8	6.7	6.6	+ 1.5	7.5	7.8	5.6	+ 39.3
Welding	—	0.2	0.4	- 50.0	3.8	3.4	4.8	- 29.2	4.5	5.6	5.9	- 5.1
Gaging/Inspection/Testing	3.9	5.1	4.5	+ 13.3	3.0	3.9	3.2	+ 21.9	6.7	3.5	3.9	10.3
Plastic mold-form equipment	0.7	0.2	0.5	- 60.0	4.2	3.4	2.8	+ 21.4	3.0	2.4	2.0	+ 20.0
Heat treating equipment	6.8	2.5	4.6	- 45.7	2.1	3.9	2.6	+ 50.0	9.8	2.4	4.8	- 50.0
All others	4.5	6.0	9.7	- 38.1	6.7	5.0	8.1	- 35.8	10.1	13.0	11.4	- 14.0

	Engines & Turbines (SIC 351)				Farm & Garden Machinery and Equipment (SIC 352)				Construction, Mining and Material Handling Equipment (SIC 353)			
	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average
Metalcutting machines	43.2	59.6	55.1	+ 8.2	19.9	18.4	25.7	28.4	38.2	41.7	45.6	8.5
Assembly equipment	7.4	4.5	6.0	- 25.0	6.0	5.9	6.5	- 9.2	3.6	6.4	5.1	+ 25.5
Metalforming machines	4.5	1.5	4.7	- 68.1	29.6	29.4	23.0	+ 27.8	14.0	13.9	11.8	+ 17.8
Material handling equipment	11.2	6.3	7.3	- 13.7	12.7	11.4	10.0	+ 14.0	11.0	7.2	10.1	28.7
Cleaning/finishing equipment	8.5	4.8	4.1	+ 17.1	8.0	10.5	9.5	+ 10.5	4.6	6.6	5.2	+ 26.9
Welding	3.0	3.7	3.5	+ 5.7	14.2	8.3	7.6	+ 9.2	9.4	8.6	8.3	+ 6.0
Gaging/Inspection/Testing	7.4	3.1	5.3	- 41.5	2.5	1.8	3.1	41.9	8.0	2.6	3.8	- 31.6
Plastic mold-form equipment	2.1	0.8	1.1	- 27.3	0.5	—	0.3	-100.0	0.3	0.8	0.5	+ 60.0
Heat treating equipment	6.1	4.7	2.9	+ 62.1	0.7	1.4	2.9	51.7	3.3	2.2	2.9	31.8
All others	10.8	11.0	10.8	+ 1.9	5.9	12.9	11.3	+ 14.2	7.5	10.0	6.4	+ 56.3

Here's How 27 Different Industries Allocate Their Equipment Dollar

Find your industry. Compare your capital spending patterns with others in your industry.
If your spending profile doesn't approximate your industry's, maybe you should be asking questions why. See page 14.

Trends in Equipment Purchases — 1981 to five year average

(Percent Total Expenditure)

	Metalworking Machinery and Equipment (SIC 354)				Special Industry Machinery (SIC 355)				General Industrial Machinery and Equipment (SIC 356)			
	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average
Metalcutting machines	61.1	62.1	63.1	1.6	43.4	48.8	52.2	5.5	48.8	49.1	48.1	+ 2.1
Assembly equipment	3.6	3.6	4.2	- 14.3	5.1	6.5	4.5	+ 44.4	8.5	10.3	9.5	+ 8.4
Metalforming machines	8.3	6.2	7.6	18.4	12.9	13.5	10.4	+ 30.8	9.4	10.8	9.8	+ 10.2
Material handling equipment	3.7	3.6	4.2	- 14.3	8.4	5.4	7.2	25.0	7.6	5.3	7.0	10.0
Cleaning/finishing equipment	4.5	4.0	2.2	+ 81.8	6.0	4.2	3.6	+ 16.7	3.0	4.9	3.4	+ 44.1
Welding	1.2	2.2	1.3	+ 69.2	7.7	6.8	5.8	+ 17.2	5.3	6.6	4.2	+ 57.1
Gaging/Inspection/Testing	4.7	5.3	5.0	+ 5.7	5.0	4.0	4.2	4.8	4.0	4.3	4.9	12.2
Plastic mold-form equipment	1.0	1.9	2.5	- 24.0	2.0	2.1	1.2	+ 75.0	1.7	0.6	1.3	53.8
Heat treating equipment	5.5	2.3	3.0	23.3	1.3	1.5	1.9	21.1	3.5	3.3	3.3	—
All others	6.4	9.6	6.8	+ 44.1	7.2	7.1	8.9	20.2	8.2	6.6	8.4	- 21.4

	Office Computing and Accounting Machines (SIC 357)				Refrigeration and Service Industry Machinery (SIC 358)				Miscellaneous Machinery, Except Electrical (SIC 359)			
	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average
Metalcutting machines	17.9	21.4	17.4	+ 23.0	20.2	22.2	19.1	+ 16.2	50.9	54.2	53.4	+ 1.5
Assembly equipment	25.3	30.1	29.1	+ 3.4	13.9	11.7	13.1	- 10.7	11.5	8.6	7.4	+ 16.2
Metalforming machines	8.8	9.2	9.0	+ 2.2	26.3	23.0	27.4	- 16.1	8.4	6.9	8.3	16.9
Material handling equipment	7.9	7.1	7.0	+ 1.4	8.8	9.7	8.1	+ 22.2	4.7	4.7	5.3	- 11.3
Cleaning/finishing equipment	5.7	4.3	5.3	- 18.9	8.1	8.8	9.3	- 5.4	6.4	7.1	5.4	+ 31.5
Welding	2.3	1.7	2.7	- 37.0	5.8	6.6	7.2	- 8.3	3.2	3.6	3.6	—
Gaging/Inspection/Testing	21.2	12.5	14.9	- 16.1	4.2	3.4	4.0	- 15.0	4.7	4.5	5.6	- 17.9
Plastic mold-form equipment	2.6	5.3	3.1	+ 71.0	2.0	4.4	3.4	+ 29.4	1.4	1.7	1.2	+ 41.7
Heat treating equipment	0.6	0.8	0.6	+ 33.0	0.3	2.4	0.5	+380.0	5.2	2.3	3.2	- 31.3
All others	7.7	8.6	10.9	- 21.1	10.4	7.8	7.8	—	3.5	6.3	6.5	- 3.1

	Electrical Transmission and Distribution Equipment (SIC 361)				Electrical Industrial Apparatus (SIC 362)				Household Appliances (SIC 363)			
	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average
Metalcutting machines	18.4	18.4	17.0	+ 8.2	32.9	31.9	28.8	+ 10.8	8.2	12.4	8.8	+ 40.9
Assembly equipment	23.5	27.6	24.8	- 11.3	22.0	22.3	20.2	+ 10.4	17.7	20.6	20.0	+ 3.0
Metalforming machines	14.0	15.1	14.2	+ 6.3	10.3	8.7	11.0	- 20.9	25.6	25.2	23.7	+ 6.3
Material handling equipment	7.5	7.2	6.5	+ 10.8	7.8	7.7	8.1	- 4.9	9.5	6.5	9.7	- 33.0
Cleaning/finishing equipment	7.7	9.8	8.3	+ 18.1	4.7	4.4	5.5	- 20.0	11.1	9.9	8.6	+ 15.1
Welding	4.9	3.6	5.2	- 30.8	3.3	2.8	3.6	- 22.2	4.7	7.3	6.3	+ 15.9
Gaging/Inspection/Testing	5.8	5.7	7.4	- 23.0	7.2	9.3	6.0	+ 55.0	3.6	3.8	3.7	+ 2.7
Plastic mold-form equipment	4.1	6.2	5.1	+ 21.6	2.9	2.8	3.9	- 17.9	11.0	6.5	7.5	- 13.3
Heat treating equipment	0.2	1.7	0.8	+112.5	0.6	1.6	1.1	+ 45.5	1.0	1.4	1.9	- 26.3
All others	13.9	4.7	10.5	- 55.2	8.3	8.5	11.9	- 28.6	7.6	6.4	9.7	- 35.1

Here's How 27 Different Industries Allocate Their Equipment Dollar

Find your industry. Compare your capital spending patterns with others in your industry.
If your spending profile doesn't approximate your industry's, maybe you should be asking questions why. See page 14.

Trends in Equipment Purchases — 1981 to five year average

(Percent Total Expenditures)

	Electric Lighting and Wiring Equipment (SIC 364)				Communication Equipment (SIC 366)				Electronic Components & Accessories (SIC 367)			
	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average
Metalcutting machines	6.5%	15.1%	14.4%	+ 4.9%	18.3%	20.6%	20.0%	+ 3.0%	17.7%	14.3%	12.6%	+ 13.5%
Assembly equipment	18.7	26.1	25.4	+ 2.8	28.6	30.1	27.8	+ 8.3	28.8	33.8	32.7	+ 3.4
Metalforming machines	28.4	18.7	18.1	+ 3.3	9.1	7.9	8.6	- 8.1	11.0	7.1	7.4	- 4.1
Material handling equipment	8.0	6.0	8.2	- 26.8	8.6	6.5	5.6	+ 16.1	4.0	4.2	3.8	+ 10.5
Cleaning/finishing equipment	13.8	8.9	7.9	+ 12.7	5.0	6.2	5.9	+ 5.1	6.3	8.7	7.2	+ 20.8
Welding	3.5	1.9	2.9	- 34.5	1.7	2.0	2.5	20.0	2.3	3.2	2.5	+ 48.0
Gaging/Inspection/Testing	2.9	3.7	4.1	- 9.8	13.3	15.2	14.9	+ 2.0	11.6	8.6	10.6	- 18.9
Plastic mold-form equipment	7.1	8.8	7.5	+ 17.3	4.2	2.5	3.6	- 30.6	9.3	5.1	7.1	- 39.2
Heat treating equipment	2.7	1.4	1.2	+ 16.7	0.5	1.4	0.9	+ 55.6	1.4	2.5	1.8	+ 38.9
All others	8.4	9.4	10.4	- 9.6	10.7	7.6	10.6	- 28.3	7.6	12.5	13.6	- 8.1

	Miscellaneous Electrical Machinery & Equipment (SIC 369)				Motor Vehicles & Motor Vehicle Equipment (SIC 371)				Aircraft and Parts (SIC 372)			
	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average
Metalcutting machines	15.5%	14.9%	14.5%	+ 2.8%	26.5%	30.5%	28.3%	+ 7.8%	51.6%	53.1%	52.4%	+ 1.3%
Assembly equipment	25.1	35.7	35.5	+ 1.0	12.6	17.0	16.7	+ 1.8	6.6	5.0	5.7	- 12.3
Metalforming machines	8.6	9.1	8.4	+ 8.3	11.7	13.2	14.7	- 10.2	9.0	9.4	8.3	+ 13.3
Material handling equipment	4.8	6.1	5.7	+ 7.0	6.3	8.6	8.7	- 1.1	3.4	3.4	3.6	- 5.6
Cleaning/finishing equipment	4.8	4.6	3.7	+ 24.3	6.2	6.5	5.6	+ 16.1	3.4	5.1	4.1	+ 24.4
Welding	4.0	4.1	3.8	+ 7.9	10.4	6.7	6.5	+ 3.1	9.4	6.2	5.8	+ 6.9
Gaging/Inspection/Testing	15.7	5.0	8.3	- 39.8	6.9	4.8	5.3	- 9.4	7.6	7.8	7.6	+ 2.6
Plastic mold-form equipment	7.4	7.3	7.7	- 5.2	7.8	3.2	3.0	+ 6.7	1.6	0.7	1.4	- 50.0
Heat treating equipment	0.6	1.3	0.7	+ 85.7	2.5	2.8	2.7	+ 3.7	2.2	3.5	4.4	- 20.5
All others	13.5	11.9	11.7	+ 1.7	9.1	6.7	8.9	- 24.7	5.1	5.8	6.7	- 13.4

	Engineering, Laboratory, Scientific & Research Instruments (SIC 381)				Measuring & Controlling Istruments (SIC 382)				Surgical, Medical & Dental Instruments & Supplies (SIC 384)			
	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average	1980	1981	5 year average	Deviation 1981 from five year average
Metalcutting machines	22.6%	27.5%	23.9%	+ 15.1%	32.5%	31.2%	29.1%	+ 7.2	16.6%	18.6%	21.6%	- 13.9%
Assembly equipment	7.3	26.3	20.0	+ 31.5	19.0	26.1	23.9	+ 9.2	30.9	30.2	25.0	+ 20.8
Metalforming machines	6.0	6.6	14.1	- 53.2	8.4	6.9	7.8	- 11.5	8.3	9.2	8.6	+ 7.0
Material handling equipment	2.3	4.5	4.6	- 2.2	5.3	4.9	4.7	+ 4.3	6.1	5.0	6.7	- 25.4
Cleaning/finishing equipment	3.0	8.2	6.0	+ 36.7	3.1	4.0	4.1	- 2.4	3.0	5.8	3.8	+ 52.6
Welding	0.9	3.1	2.8	+ 10.7	3.2	4.0	5.3	- 24.5	4.1	2.5	4.6	- 45.7
Gaging/Inspection/Testing	22.4	10.5	12.1	- 13.2	7.5	9.1	7.0	+ 30.0	6.6	5.2	8.7	- 40.2
Plastic mold-form equipment	12.9	1.1	3.8	- 71.1	11.5	4.7	6.6	- 28.8	14.4	14.9	11.3	+ 31.9
Heat treating equipment	0.3	1.3	0.5	+160.0	1.0	1.8	2.0	- 10.0	1.4	1.1	0.7	+ 57.1
All others	22.3	10.9	12.1	- 9.9	8.5	7.3	9.6	- 24.0	8.6	7.5	8.6	- 12.8

Spending Patterns

For each of the eight production equipment categories shown below, the industries that are listed account for the bulk* of the total 1981 investment in that type of equipment. Industries not listed do not invest significantly in equipment of that type.

You can compare your company's investment pattern with your industry's spending plans by determining the percentage of your capital investment budget that will go for each of these eight equipment categories.

---

*These industries account for 75 percent or more of the planned investment for these types of equipment according to our survey.

Cleaning-Finishing Equipment

SIC	Industry	Percent of Total Capital Expenditures
342	Cutlery, hand tools & hardware	10.8%
343	Heating equip., except electric & plumbing fixtures	9.3%
344	Fabricated structural steel prod.	9.1%
346	Forgings & stampings	6.7%
349	Misc. fabricated products	7.8%
352	Farm & garden machinery	10.5%
358	Refrig. & service industry machy.	8.8%
359	Misc. machy., except elec.	7.1%
361	Elec. transmission & dist. equip.	9.8%
363	Household appliances	9.9%
364	Elec. lighting & wiring equip.	8.9%
367	Electronic components & access.	8.7%
371	Motor vehicles, motor veh. equip.	6.5%
381	Engineering lab, scientific & research instruments	8.2%

Metalforming Machinery and Equipment

SIC	Industry	Percent of Total Capital Expenditures
342	Cutlery, hand tools & hardware	16.1%
343	Heating equip., except elec. & plumbing fixtures	17.1%
344	Fab. structural steel products	22.8%
345	Screw machine products	16.4%
346	Forgings & stampings	40.1%
349	Misc. fabricated products	14.6%
352	Farm & garden machinery	29.4%
353	Construction, mining, oil field & matl. handling equip.	13.9%
358	Refrig. & service industry machy.	23.0%
361	Elec. transmissiion & dist. equip.	15.1%
363	Household appliances	25.2%
364	Elec. lighting & wiring equip.	18.7%
371	Motor vehicles, motor veh. equip.	13.2%

Heat Processing Equipment

SIC	Industry	Percent of Total Capital Expenditures
342	Cutlery, hand tools & hardware	5.2%
343	Heating equip., except electric & plumbing fixtures	3.6%
346	Forgings & stampings	3.9%
351	Engines & turbines	4.7%
353	Construction, mining, oil field & matl. handling equip.	2.2%
354	Metalworking machy. & equip.	2.3%
356	General industry machy. & equip.	3.3%
358	Refrig. & service industry machy.	2.4%
359	Misc. machy., except elec.	2.3%
367	Electronic components & access.	2.5%
371	Motor vehicles, motor veh. equip.	2.8%
372	Aircraft & parts	3.5%

Metalcutting Machine Tools

SIC	Industry	Percent of Total Capital Expenditures
345	Screw machine parts	51.8%
349	Misc. fabricated products	31.3%
351	Engines & turbines	59.6%
353	Construction, mining, oil field & matl. handling equip.	41.7%
354	Metalworking machy. & equip.	62.1%
355	Special industry machy.	48.8%
356	General indl. machy. & equip.	49.1%
359	Misc. machy. except elec.	54.2%
362	Electrical indl. apparatus	31.9%
371	Motor vehicles, motor veh. equip.	30.5%
372	Aircraft & parts	53.1%
382	Measuring & controlling instruments	31.2%

Assembly Equipment

SIC	Industry	Percent of Total Capital Expenditures
342	Cutlery, hand tools, hardware	15.8%
343	Heating equip., except electric & plumbing fixtures	17.2%
344	Fabricated structural steel prod.	14.4%
349	Misc. fabricated products	14.6%
356	General industry machy. & equip.	10.3%
357	Office, computing & acctg. machy.	30.1%
358	Refrig. & service industry machy.	11.7%
361	Elec. transmission & dist. equip	27.6%
362	Elec. industrial apparatus	22.3%
363	Household appliances	20.6%
364	Elec. lighting & wiring equip.	26.1%
366	Communications equipment	30.1%
367	Electronic components & access.	33.8%
369	Misc. electrical machy., equip., supplies, nec.	35.7%
371	Motor vehicles, motor veh. equip.	17.0%
381	Engineering lab, scientific & research instruments	26.3%
382	Measuring & controlling instruments	26.1%
384	Surgical, medical & dental instr. & supplies	30.2%

Gaging-Inspection and Testing Equipment

SIC	Industry	Percent of Total Capital Expenditures
345	Screw machine products	5.1%
354	Metalworking machy. & equip.	5.3%
355	Special industry machy.	4.0%
356	General indl. machy. & equip.	4.3%
357	Office, computing & acct. machy.	12.5%
359	Misc. machy. except elec.	4.6%
361	Elec. transmission & dist. equip.	5.7%
362	Elec. industrial apparatus	9.3%
366	Communications equipment	15.2%
367	Electronic components & access.	8.6%
369	Misc. electrical machy., equip. supplies, nec.	5.0%
371	Motor vehicles, motor veh. equip.	4.8%
372	Aircraft & parts	7.8%
381	Engineering lab, scientific & research instruments	10.5%
382	Measuring & controlling instruments	9.1%
384	Surgical, medical & dental instr. & supplies	5.2%

Plastic Molding Equipment

SIC	Industry	Percent of Total Capital Expenditures
342	Cutlery, hand tools & hardware	3.7%
343	Heating equip. except electric & plumbing fixtures	4.5%
346	Forgings & stampings	3.4%
357	Office, computing & acctg. machy.	5.3%
358	Refrig. & service industry machy.	4.4%
361	Elec. transmission & dist. equip	6.2%
363	Household appliances	6.5%
364	Elec. lighting & wiring equip.	8.8%
367	Electronic components & access.	5.1%
369	Misc. electrical machy., equip. supplies, nec.	7.3%
371	Motor vehicles, motor veh. equip.	3.2%
382	Measuring & controlling instruments	4.7%
384	Surgical, medical & dental instr. & supplies	14.4%

Weld - Rivet - Braze Equipment

SIC	Industry	Industry Capital Expenditures
343	Heating equip., except electric & plumbing fixtures	8.7%
344	Fab. structural steel products	13.9%
349	Misc. fabricated products	5.6%
352	Farm & garden machinery	8.3%
353	Construction, mining, oil field & matl. handling equip.	8.6%
355	Special industry machy.	6.8%
356	General indl. machy. & equip.	6.6%
358	Refrig. & service industry machy.	6.6%
363	Household appliances	7.3%
369	Misc. electrical machy., equip. supplies, nec.	4.1%
371	Motor vehicles, motor veh. equip.	6.7%
372	Aircraft & parts	6.2%
382	Measuring & controlling instruments	4.0%

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May 1981

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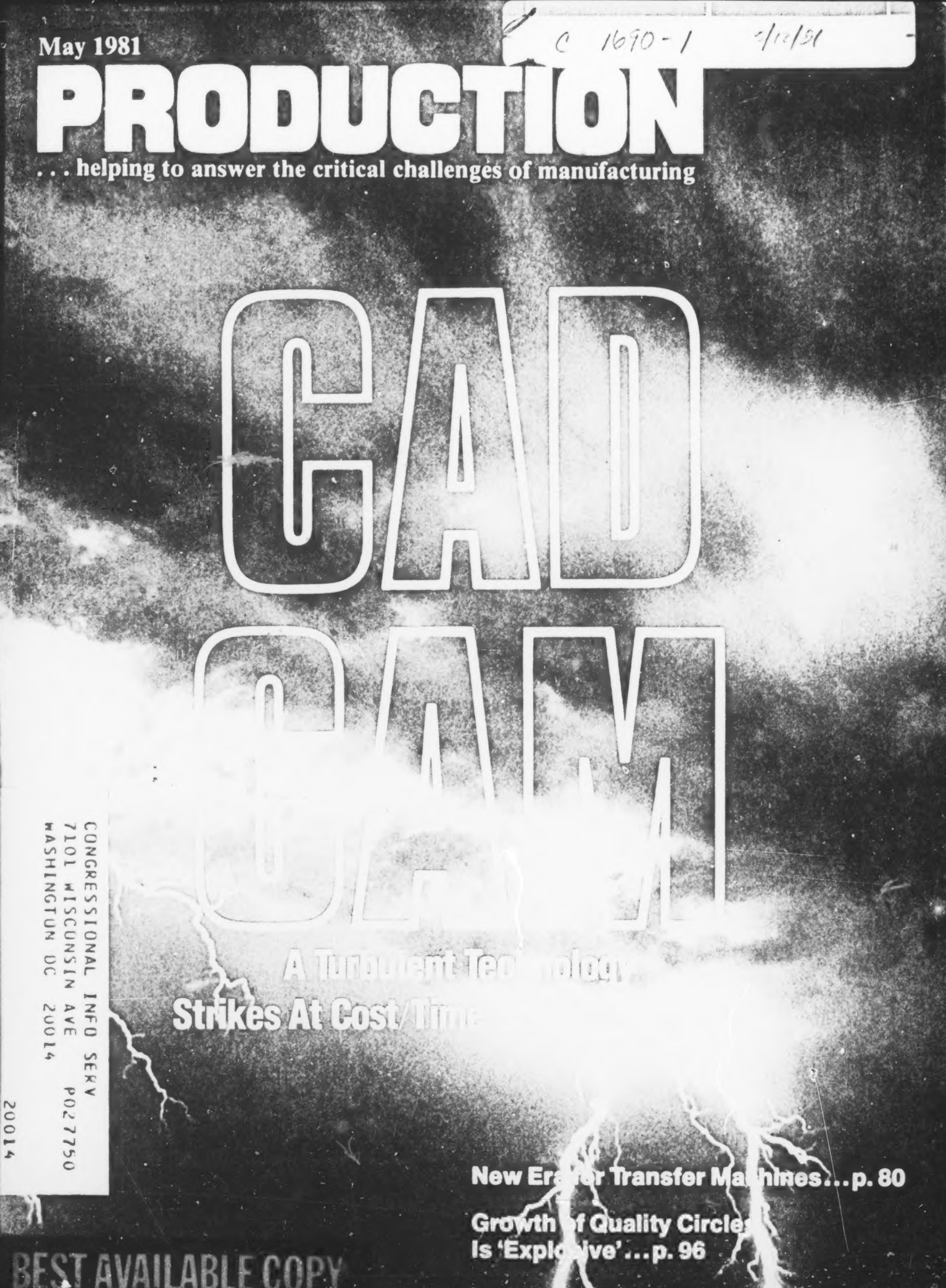

CAD CAM

A Turbulent Technology

Strikes At Cost/Time

New Era for Transfer Machines . . . p. 80

Growth of Quality Circles Is 'Explosive' . . . p. 96

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It is the purpose of **PRODUCTION** to recognize and to fulfill the special needs of the managers and engineers who are responsible for improving manufacturing efficiency, costs and quality in production metalworking plants, and selected supplier industries.

May 1981
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Round Table

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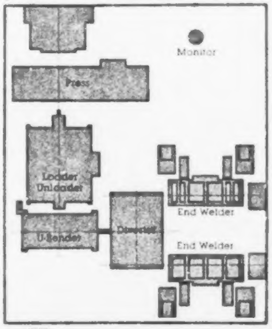

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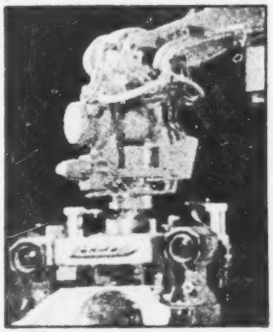

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Cover: CAD/CAM has awesome power. Adequate preparation is vital

Next Month: Spotlight on the manufacturing engineering profession

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No let-up seen for auto and parts makers

DANGER!

Rough Road Ahead

With smaller, more fuel-efficient vehicles coming out of domestic auto plants and more in advanced stages of gestation, it's often assumed that the industry has about passed through its crisis period.

That, however, is not the message contained in an extensive Delphi-type study warning that the foreign invasion will not abate and that the domestic parts production base will significantly erode. Productivity improvements in the domestic industry won't be enough to erase the cost advantages held by the Japanese producers and sufficient money for capital investments by parts suppliers won't be available. It also is problematical whether the necessary improvements in relationships between government, labor and the industry's members can be developed.

The brightest thing about this study is that it has been made and is being looked at carefully by all the involved parties. That it highlights substantial differences in the parties' perceptions of what the major problems are may be one of its greatest values.

The nationwide study was made by the Auto Supplier Action Council (a newly formed arm of the Michigan Manufacturers Association) and the Detroit office of Arthur Andersen & Co. Also participating was the Transportation Systems Center of the U.S. Department of Transportation.

Four separate, independent "panels," consisting of parts suppliers, capital equipment producers, financial organizations, and government people, were surveyed during November and December in two rounds of questioning.

The part supplier panel involved 90 companies, with respondents mainly of chairman, president or vice president rank. Forty-eight capital equipment companies participated and chairmen, presidents and vice presidents were the major sources of the opinions. Officials of 22 financial organizations, mainly banks and investment firms, constituted the financial panel. Twenty-five government officials, mainly in higher-level bureaucratic positions, also participated.

The domestic vehicle producers were not contacted because of their reluctance to divulge financial information and organized labor was omitted because it contains too few separate entities, according to Peter Van Hull, the Arthur Andersen partner who organized the study.

Before the results of the study were publicly disclosed, its findings along with a number of recommended actions were presented to U.S. Transportation Secretary Drew Lewis and the Michigan Congressmen.

A "Flat" Market. Virtual stagnation of the passenger car and light truck markets in the U.S. throughout the 1980-1990 period and continuation of a foreign vehicle share of the market at 21-24.3 percent throughout the period are the study's two main points.

Growth of the passenger car market is projected as averaging less than 1 percent a year, reaching 11.5-12 million units in 1990. Light trucks will show no growth in the first half of the decade and only minimum growth in the second half. Heavy-duty truck market growth will average 2-4 percent a year throughout the period.

(General Motors Corp., contacted after the study was released, disagrees with the car market outlook; it sees a 2-3 percent annual growth.)

Dealing extensively with the outlook for the parts supplier industry which has been generally overlooked in past examinations of the automotive industry's problems, the study sees the U.S. OEM parts market growing at a 2 percent average rate throughout the decade. However, it also sees the abdication of the market by a number of present suppliers and significant encroachment by foreign producers.

The permanent job loss in the vehicle-producing industry is seen as nearly 200,000 workers from the 1979 level, while employment in auto parts supplier plants will decline by up to 400,000 persons.

The problems for the suppliers and the vehicle producers can be extrapolated from the survey's detailed findings into four types: technology/productivity problems, capital investment problems, relationships problems, and perception problems.

TECHNOLOGY/ PRODUCTIVITY

All four panels believe the Japanese vehicle manufacturers lead U.S. manufacturers in production methods and manufacturing technology by about three years. They see a close intertwining of Japanese labor relations, including such participative methods as Quality Circles and few divisions of labor, with the productivity advantage. The part supplier panel, in fact, rates Circles as the most important method by which U.S. productivity could be increased. An interesting comparison of where our manufacturing technology is perceived to stand versus that of Japan and Europe is contained in the chart below.

Looking at themselves, the U.S. parts producers forecast they could achieve a 10 percent increase in productivity by 1985 and again by 1990 through the use of new equipment and tools. This forecasted improvement is only half of what the capital equipment panel believes could be accomplished.

Identifying the forms of automation that could lead to this improved productivity by 1985, the part supplier group ranks robots as most important, while programmable controllers, automated assembly machines and automatic loaders/unloaders come next in importance, followed by automatic inspection, then by transfer lines and flexible machinery systems.

The capital equipment panel ranks robots, programmable controllers and automated assembly machines as the greatest potential contributors to improved productivity; it places automatic inspection and transfer lines as of next importance; these are followed in importance by automatic loaders/unloaders and flexible machinery systems.

The parts suppliers think a 10 percent reduction in setup times could be obtained in each half of the current decade. The capital equipment producers see the possibility of a much greater reduction—at least 35 percent by 1990. Numerically controlled machines are the equipment producers'

MANUFACTURING TECHNOLOGY U.S. COMPETITIVE POSITION VS. JAPAN AND EUROPE

Percent of Responses

U.S. Position vs. Japan	Parts Supplier Panel	Government Panel	Financial Panel	Capital Equipment Panel
U.S. lead	19%	19%	28%	33%
U.S. lag	78	69	72	50
Equal	3	12	0	17
U.S. Position vs. Europe				
U.S. lead	41%	38%	76%	50%
U.S. lag	56	24	12	21
Equal	3	38	12	29

prime solution to setup-time reduction, followed by throwaway or preset tooling, pallet shuttle machines, rolling die bolsters and die set trucks.

In a separate earlier study last year by Arthur Andersen & Co. with all U.S. vehicle producers and 12 key parts suppliers, possible revisions in plant systems were calculated to provide as much productivity improvement opportunity as new equipment and tools—10 percent by 1985 and an additional 10 percent by 1990.

CAPITAL INVESTMENT

U.S. vehicle manufacturers are expected to spend $14 billion a year (in 1980 dollars) until 1985 for capital equipment and facilities.

The domestic parts supplying industry was estimated to have spent $2 billion for these items in 1980 and is predicted to increase that expenditure by a 2 percent annual rate during the decade.

The parts supplier panel looks for a 16 percent annual growth rate in capital expenditures by the vehicle manufacturers through 1985 and a 12 percent rate from then until 1990. Their own annual increase in capital expenditures is predicted at 10 percent in the first half of the decade and 8 percent in the last half (an actual decline in view of inflation expectations). A shift away from physical plant (25%) and toward new machine tools/tooling (60%) is expected by this group.

The capital equipment panel looks for even less equipment investment by the parts suppliers.

This panel also expects the proportion of machine tool industry sales to the automotive industry and its suppliers to decline from the 48 percent of total in 1980 to 38 percent (vehicle producers 29%, suppliers 9%) of total machine tools sales in 1985.

The parts industry's sourcing of machine tools from foreign manufacturers is expected to double by 1985, to about 20 percent. The vehicle producers are expected to increase the proportion of purchases of foreign-made machine tools from a present 10 percent to 13 percent by 1985.

The parts supplier panel and the capital equipment panel concur that lower cost and innovative or superior-quality machines are among the primary factors encouraging purchase of foreign-built machine tools. Shorter leadtime is considered the most important factor by the capital equipment panel and the least important by the parts supplier panel. Lower cost is ranked by the parts supplier panel as the most important advantage, and the builder group ranks it as second in importance.

There's little agreement between the groups on what the problem is

The part supplier panel forecasts a change of their industry from a medium-risk and return (on investment) industry in the 1970s to a high-risk, low-return industry in the 1980s. A rate of return of 12-13 percent on new investments is projected.

The financial panel forecasts even lower returns on investment in the automotive industry as a whole (11% in 1985). Seventy-nine percent of the financial panelists consider the major investments needed by the industry to be economically feasible.

RELATIONSHIPS

All panels agree that the business climate for the automotive industries in Europe and Japan is improved by the joint industry, labor and government cooperation that exists in those countries. All panels likewise agree that providing investment incentives should be a primary U.S. government policy role for improving the international competitiveness of U.S. vehicle and parts manufacturers. The panels all agree also that relaxing government regulations is critical to our vehicle producers.

The need for an improved labor/management relationship that will foster more involvement by workers in decision-making and will eliminate much of the elaborate system for division of labor in U.S. plants is heavily stressed in connection with the industry's productivity problems. Also mentioned is the need for wage restraint and willingness to share business' risk through profit-sharing schemes.

DIFFERENT PERCEPTIONS

Many significant differences show up in the perceptions the various panels have toward the nature and the severity of the industry's problems. Calling attention to these differences may be one of the study's most constructive aspects.

The government panel is the most optimistic about the industry's outlook in terms of vehicle sales and import vehicle penetration. The financial panel is the most pessimistic.

The government panel sees capital investments as holding most promise for improved operating conditions in the industry while the other panels focus on the need for better relations between labor, industry and government and for new manufacturing systems/approaches.

The government panel ranks regulations as significantly less detrimental to the industry than the other panels do.

How rough the road ahead is may be a matter for some disagreement, but it surely will be worse if the parties can't get a cooperative act together.

Howard C. Tuttle □

June 1981

PRODUCTION

. . . helping to answer the critical challenges of manufacturing

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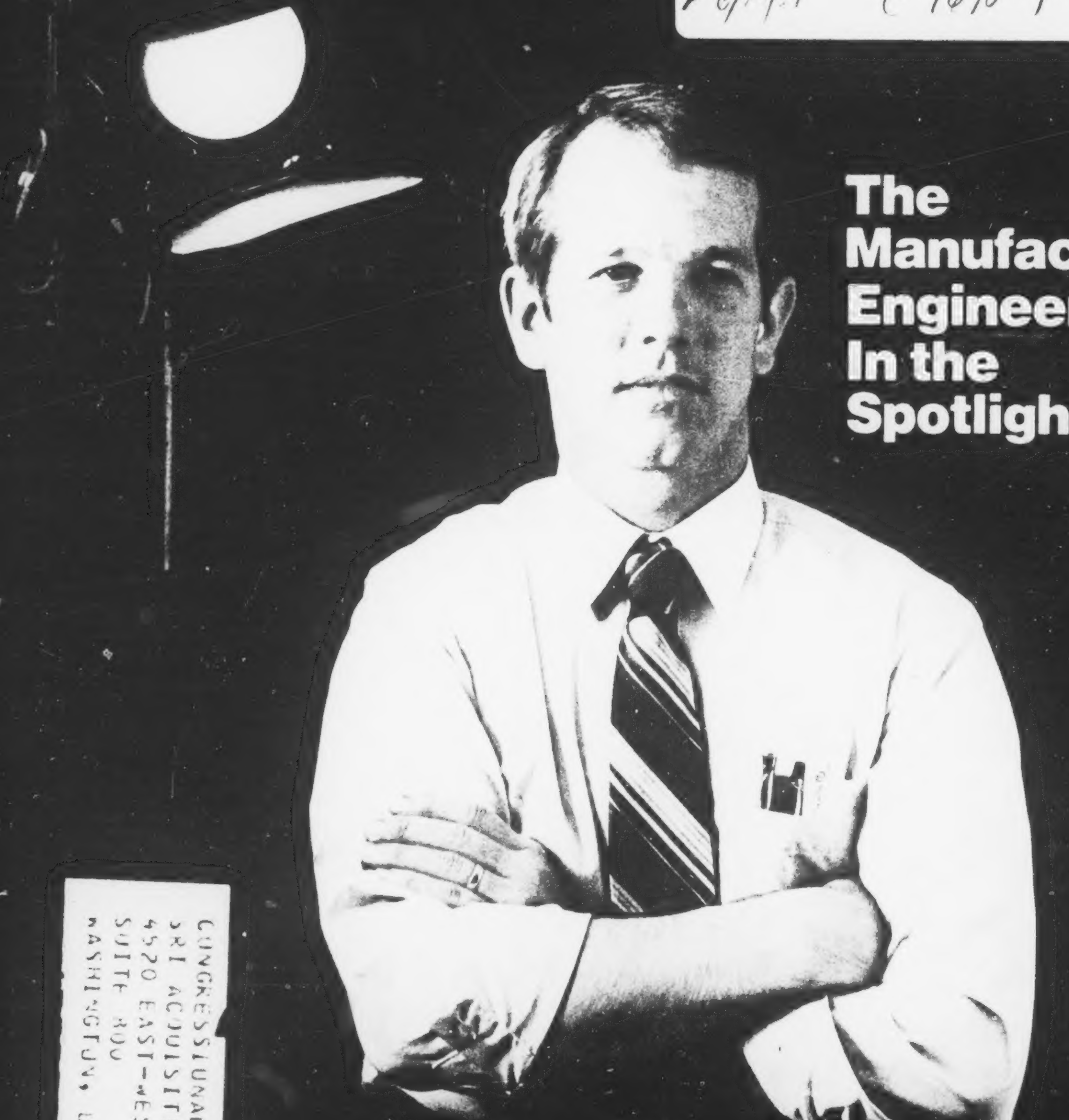

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It is the purpose of **PRODUCTION** to recognize and to fulfill the special needs of the managers and engineers who are responsible for improving manufacturing efficiency, costs and quality in production metalworking plants, and selected supplier industries.

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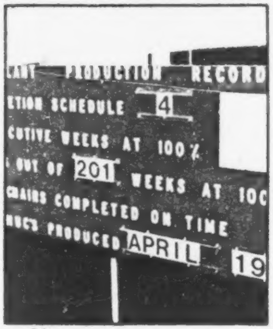

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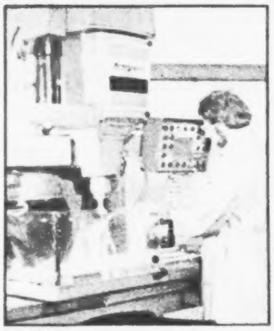

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Cover: Tom Westman, our "manufacturing engineer" model, actually is the husband of our Director of Graphic Design

Next Month: Quality provides the big push to automatic assembly

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The Manufacturing Engineer

In the Spotlight

On him (or her) depends a company's capability to produce current products better and lay plans for how tomorrow's products will be buil

At one time, industry had to home-grow its own "master mechanics" through an apprenticeship and then season them in the sch of hard knocks. Later, engineering schools took over. But now, the

"When a person has responsibility for dealing with today's problems along with responsibility for tomorrow's, he never has a chance to look at tomorrow."

This statement sums up the most common complaint of manufacturing engineers. Said in another way, manufacturing engineers consider "firefighting" the major part of their work, and they don't feel their organizations give them time or support for development of the large-scale manufacturing improvements that everyone says will be present in "the factory of the future."

As a partial solution to this complaint, the vice president of manufacturing for a high-technology industrial company says: "We're trying to identify obsolescence both in terms of ability and technology and then bring into play not generalists but experts to initiate new projects."

Where those experts will come from is another problem, as expressed by a veteran university professor: "I find the quality of the graduate in manufacturing and/or design has deteriorated markedly in the last five years and see little or no hope of reversing this trend in the near future. . . .I shudder to think what will develop in the M.E. (mechanical engineering) program when we fuddy duddies die off. The new professors have little or no knowledge of manufacturing."

The executive director of an executive search firm well-respected in manufacturing circles comments: "If I were to point out the most common weakness in manufacturing engineering or industrial engineering candidates it would be in lack of personal marketing skills—selling their own accomplishments. This goes hand in hand with a weakness in communication skills."

"Industry isn't attracting the best engineers with MBA degrees. They're going where there's more money—finance or consulting," says a top-flight consultant. (Current salary levels of mechanical and industrial engineers are shown below.)

As these five different viewpoints suggest, the manufacturing or industrial engineer is a vital but

The Current Salary Picture

Of the ten most sought-after engineering disciplines, mechanical engineers now rank third and industrial engineers rank sixth coast to coast, according to a survey conducted by Fox-Morris Personnel Consultants, Philadelphia.

The demand for MEs is 13.4 percent higher than a year ago, while 9.6 percent more IEs are being sought.

At the top of the "big ten" list of engineering specialties are electronics/electrical engineers, enjoying a 14.1 percent rise in demand; at the bottom of the list, with an 8.7 percent increase are metallurgical engineers.

Salaries being offered to and accepted this year by the MEs and IEs, in three different experience levels, are as follows:

Country-wide	Just Graduated Avg. (and Avg. High)	2-5 Years Exp. Avg. (and Avg. High)	Management-level Exp. Avg. (and Avg. High)
Mechanical engineers	$21,450 (22,500)	$27,450 (30,100)	$37,400 (42,000)
Industrial engineers	$19,050 (20,900)	$25,400 (29,100)	$35,050 (40,600)
Geographical Location			
Philadelphia Area	MEs $23,000	$28,500	$40,000+
	IEs $23,000	$28,700	$35,000+
Atlanta Area	MEs $22,000	$29,300	$41,100+
	IEs $20,600	$26,000	$38,400
Boston Area	MEs $22,000	$28,000	$35,000+
	IEs $19,500	$27,000	$37,000+
Detroit Area	MEs $19,000	$25,000	$40,000+
	IEs $18,000	$24,000	$35,000+
Los Angeles Area	MEs $21,650	$27,700	$37,800
	IEs $19,450	$25,800	$35,500
Houston Area	MEs $22,100	$28,800	$39,000+
	IEs $20,750	$26,500	$38,000+

imperfectly configured cog in today's manufacturing system. The student in a curriculum leading to a job as a manufacturing engineer has little information on which to base his career choice. And after he's been in that job for a period of time, he feels he's often saddled with clerical or technician tasks that don't require his full abilities. Furthermore, to win promotion he must develop and demonstrate skills that weren't part of his degree requirements.

What those comments don't reflect, however, is the intense satisfaction most manufacturing and industrial engineers are getting from being in these seemingly ill-formulated professions.

The positions' satisfaction-providing attributes, the variety of challenges, and some of the changes taking place in emphasis are conveyed in a survey made of PRODUCTION's readers and in the accompanying profiles of six young industrial and manufacturing engineers. Ranging in age from 27 to 39, these men were selected for spotlighting from among PRODUCTION's readers not because of particular accomplishments or career objectives but because they are working in representative progressive companies and they reflect the variety of educational backgrounds that typically characterizes the manufacturing/industrial engineer.

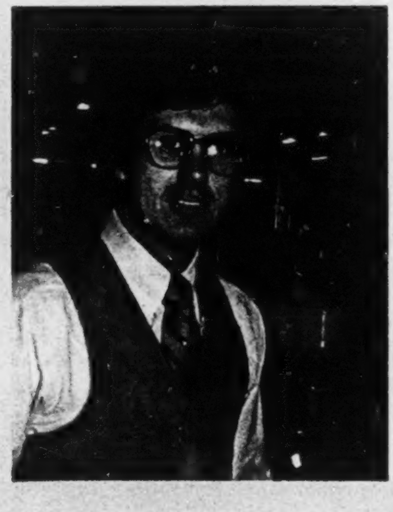
Their mobility, experiences, and apparent ease of shifting into many functional areas in their companies suggest that the manufacturing/industrial engineer is, as one knowledgeable recruiter calls him, "the modern-day Renaissance man."

A Lesson from Space? In the right kind of organizational environment, it is people like these who will cast the shape of the factory of the future.

It is generally acknowledged that the greatest significance of the "Columbia" space shuttle's successful flight was the amazing ability of NASA and Rockwell, the prime contractor, to design, organize and manage an incredibly complex system. The technologies represented were awesome and the training and skills of the participants were vital components, but putting the elements together into a cohesive, dedicated whole was the program's supreme accomplishment. Industry's job if the much-talked-about systems for computer-integrated manufacturing can be brought into being will be similar. Yet, for the most part, it is the hardware and technology that gets the emphasis; the required manufacturing system and the needed people skills receive minimal attention.

Wickham Skinner, professor in the Harvard Graduate School of Business Administration, addressed this crucial aspect of the so-called factory of the future at last winter's annual meeting of the Production Engineering Div. of the American Society of Mechanical Engineers.

"It is clear," declared Professor Skinner, "that the availability of equipment and mechanisms has far outrun the ability of the modern factory system to absorb these new technologies. Somehow management in the manufacturing world has apparently been unable to fully assimilate the new technologies which engineers and scientists have made available. . . .We have the ironic situation of industry loaded with unused technology yet in trouble in terms of competition, costs, flexibility for volume and product change, return on investment, ability to attract young, able people, 'blue-collar blues,' layoffs, unemployment, strikes, plant closings and a gradual shift from man-



Profile: **John J. McGara**

Age: 32

Title: Manager of Industrial Engineering, Van Dyke Plant, TRW Michigan Div.

Location: Sterling Heights, MI

Education: Graduate of Ohio State University in Industrial Engineering

MBA-Finance from University of Toledo

Marital Status: Married

Already experienced far beyond his years, John McGara is on the fast track in the high-pressure atmosphere of an automotive industry supplier.

He got his MBA in Finance at night while working as an industrial engineer at City Auto Stamping Div. of Sheller-Globe in Toledo, OH, and at Elastomer Products Div., Gould, Inc., and joined the industrial engineering staff of the Van Dyke Plant in suburban Detroit of TRW Michigan Div. four and a half years ago.

A year and a half later, he was promoted to industrial engineering manager of the approximately 800-employee plant where he became responsible for developing the facility's capital investment programs at a boom time. Now, he's in charge of shaping the plant's cost improvement programs, the largest in its history.

As this has gone on, the plant's product mix has been undergoing significant changes—the OE busiufacturing to service industries."

His fundamental question was: Will the factory of the future always remain "in the future"? And his answer was "yes" unless a change of critical importance takes place in the way manufacturing is managed.

Its emphasis, he said, must change from taking the *operating* point of view, based on daily, weekly and yearly positions, to developing the long-range manufacturing strategy and structure that will enable the total organization "to get out ahead of the problems, away from a reactive mode."

In making this analysis, Professor Skinner concurs exactly in what our survey of readers in manufacturing engineering positions told us is the major problem. Misplaced priorities dictate that much of their work is of the "fire-fighting" kind.

However, the way the jobs of several of the young men we profiled have recently changed is encouraging proof that in some companies the structure, strategy and personnel for breaking away from the traditional short-range concentration are being developed.

Involvement of industrial and manufacturing engineers with upstream designing for producibility is a key change. One of these men calls it "automating your product and not just your process" and emphasizes the importance of the difference. Another stresses the search for ways of compressing the time span of the design/manufacturing cycle, and another says his plant gets a "double whammy" when the new equipment specified is conventional and the flexible automation he thinks is needed cannot be economically justified under current payback requirements.

That significant changes in traditional manufacturing methods and systems are occurring were indi-

The Goods and Bads of Mfg. Eng.

The outstanding job-satisfaction characteristic of the work of a manufacturing engineer is: "You get the chance to take a project from beginning to completion—you get a great sense of accomplishment."

The two largest frustrations are: "You're always fire-fighting," and "Too much clerical-type work."

A group of PRODUCTION's readers received an open-ended questionnaire asking what aspects of their work they liked best, and least.

Among major favorable comments were: "Immense variety of work." "Challenging." "Doing hands-on work." "Using new, innovative ideas." "Skill is portable." "Opportunity for contact with outsiders and professional groups." "Chance to sell ideas and sell self." "Large company permits experimentation."

Major sources of frustration included: "Input is allowed too late after the product is designed." "Blamed for product costs but not allowed 'say' in product design." "Too few managers with mfg. eng. background." "Doing work a technician should do." "Little done to help become more productive—no computer terminal, have to beg for supplies, lack of quiet work space." "Not enough money for R&D—firefighter." "Company not willing to take risk in new mfg. methods." "Need dual ladder for advancement—one in management, one in area of specialization." "Too much emphasis on educational attainments."

On balance, everyone of our respondents said they enjoy the work.

---

ness in high-volume, long-run steering gear components has declined while the aftermarket requirements in lower volumes and greater variety have increased. New approaches in costing as well as in processing and material handling have been required.

Industrial Engineering, as the profession is practiced in this and several other divisions of TRW, is the umbrella organization for all capital resources planning as well as the traditional industrial engineering functions of work standards development and measurement. One section in the department establishes the total organization's budgets, standards and new product costing. The second is responsible for improvement of the plant's materials handling operations—an area currently receiving major attention. A third responsibility is capital investment planning, justification and proposal preparation.

With respect to his in-college preparation for this challenging work, John is high in his praise for the Industrial Engineering program at Ohio State with its heavy hands-on emphasis on manufacturing processes. He also is enthusiastic about the MBA program, "which I thoroughly enjoyed."

He sought the MBA degree because "working as an engineer in my discipline it's hard to see the total picture; your focus is fairly limited at that level." The MBA program also "gave me good experience in making presentations to groups and selling my ideas," he notes.

Still developing his skills in that area, John says he's currently taking a Dale Carnegie course under the tuition-refund program offered by TRW to its employees.

Where will John McGara be in five years?

"My career interest is in operations management," he says. "I want to get a plant managership in TRW within five years. Then I anticipate some lateral moves that will take me out of the IE area and broaden my experience. Further down the road, say within ten years, I'd like a shot at a division general managership."

cated in two articles appearing in PRODUCTION last month. "New Era for Transfer Machines" described what is called industry's first integrated transfer machining system with robot loading/unloading and automatic material handling. The system is in operation at General Motors' Three Rivers, MI, Hydra-matic Div. plant. In "A Turbulent Technology Strikes at Cost/Time Barriers," the experiences of eight companies in installing CAD/CAM systems were described.

Several of the new technologies needed for "the factory of the future" are encompassed in these examples. The literature also contains numerous listings of what these technologies are likely to be. A well-detailed one is that developed by Battelle Columbus Laboratories for the Society of Manufacturing Engineers and presented in the 1979 report on "The Manufacturing Engineer—Past, Present and Future." Professor Skinner cites a list developed in 1980 by Joel Goldhar and A. Avakian for the National Research Council.

What mainly is lacking with respect to these technologies, according to Professor Skinner, is management pressure to put them in place. He identifies six managerial roadblocks:

- "Short-term financially dominated point of view in top and manufacturing management, with reward systems based principally on performance against annual budgets. . .
- "High hurdle rates for investment paybacks.
- "Top management inexperience in manufacturing and a more typical financial/marketing orientation.
- "Risk aversion by corporate executives relative to major new innovative investments.
- "Managers in the manufacturing sector have typically not been sufficiently innovative, daring or shown the leadership necessary for proposing major new high-risk factories, or to break away from the safe, tried-and-true.
- "Too many manufacturing managers focus on the short-term: meeting the monthly schedule, bogeys for quality and delivery, and labor/personnel problems. They lack a strategic point of view."

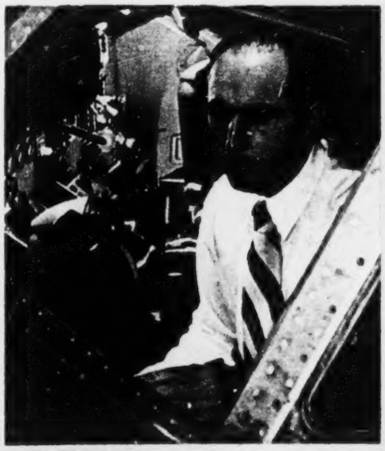
Not immune from his criticism are those engineers who also are unwilling or unable to effectively utilize leading-edge technologies, which will "rapidly make outdated a generation of technical people who cannot cope."

Heartening Signs. However, says Professor Skinner, a "new breed" of manager able to dismantle these roadblocks and to instill new philosophies about manufacturing is emerging.

"This new breed is competent not only in technology but in management. S/he focuses on design and operations with equal facility, has a broad viewpoint that copes not only with technology but coordination, systems and people. They focus on entire interrelated systems and operations and not just on individual equipment or departments or functions." However, the "old breed," he says, is predominant and "the 'new breed' is too limited in number and youthful in age and organizational level in most organizations yet to tip the scale." Yet, in many companies, he reports,

Profile: Garnet W. Hizzey

Age: 39
Title: Manufacturing Engineer, 707/727/737 Div., Boeing Commercial Airplane Co., Seattle
Education: 5-year student-apprentice, Rolls Royce Ltd.; graduated manufacturing engineer. Two years at Cranfield Institute of Technology, Bedford, England; graduated Master of Science in Production Engineering
Marital Status: Married, three sons



Garnet Hizzey was recruited by Boeing in London immediately after his graduation from Cranfield. He moved to Seattle and spent his first five years in detail planning—planning the manufacture of a myriad of machined and formed parts for airplanes. During this period he also began to work with computers in manufacturing planning and management.

Since 1971, Garnet has spent most of his time in airplane assembly and installation. But it has not become routine. He has been a member of task forces that have worked on product and producibility problems at Vertol Div. in Philadelphia, and at Boeing plants in Wichita, KS, and Portland, OR. Based in Seattle the whole time, Hizzey explains his participation in these teams:

"I think I have been selected because of my broad technical background and experience in manufacturing, plus the fact that I enjoy working with people. I seem to be able to get things rolling. I have drawn an uncommon number of assignments such as these. It certainly does round out my experience, because I get into all phases of production and manufacturing, many of which I would otherwise have nothing to do with."

At present, Hizzey is heading up

"moved by the engine of change, the focus is clearly moving back to manufacturing after 20 years of high cost, slumping productivity, poor quality, unstable labor relations and the inability to compete. The pressures are economic, and there is leadership being developed and momentum being created."

Among companies where the new strategic manufacturing approach to manufacturing management, deemed necessary by Professor Skinner, is being developed is TRW, Inc., Cleveland.

The occupant of the newly created corporate position of vice president-manufacturing, Gus Schrader, contends that some organizations are more accepting of the necessity for change than others. Willingness to take a risk is a basic difference.

Some companies, he suggests, "have tunnel vision on how to get 'from here to there.' Whatever they want to do, it must be done with zero risk." At TRW, creation of an environment for innovation and encouragement of acceptable risk-taking are stressed.

"Innovation," he declares, "is what will keep us at the head of the pack." The broad-based human resources programs in the company aim, in part, at equipping people at all levels both to initiate and to welcome change. "We put a lot of effort into helping people grow," he emphasizes.

When the suggestion was made to him that the company appears to be placing a strong emphasis on youth, as indicated by the rapid progress of one of the men profiled (see p. 72), Schrader, a veteran of 15 years at TRW, much of it as a vp in operations, responded: "I don't think our emphasis is on youth.

Hints on 'Getting Ahead'

☐ Analyze area(s) of weakness and strengthen it (them). Communication skills and human relations skills are particularly important.

☐ Learn how to present right kind of information. Emphasize benefits to company of proposed action/equipment purchase. Do the same in "selling yourself"—capitalize on the dollar benefits of your work, not on your specific responsibilities.

☐ Work at finding out about other departments/functions within your company.

☐ Keep your options open. Avoid being pigeon-holed both in areas of interest/expertise and in types of work experience.

☐ Take advantage of every available opportunity for self-development.

☐ Use your professional society(ies) for further knowledge in your specialty, contacts, prestige.

☐ Look, think, act successful.

---

a team that's working on the engine strut for an elongated version of the twin-engine 737.

"Because the strut is short and dense, we'll have access problems in assembly. We'll be able to do very little drilling of holes at that point. We'll have to produce full-size holes and holes with coordinated locations so we can manage the final assembly problems. We expect we'll have to develop some new equipment," he adds.

Hizzey's team has six from manufacturing engineering plus others from design, tooling, materials, industrial engineering, quality control and fabrication.

"This multidiscipline approach to the problem is important," he stresses. "Because of the nature of the task, manufacturing engineering has assumed the chairmanship, but we are all working on the same problems at the same time. Processes will include machining, welding, heat treating and varieties of bonding and fastening.

"Since weight is more critical now than it has ever been, composite materials and designs must continuously take weight into consideration. Assembly adjustment allowances have been designed out because they add weight. Accuracies are greater; tolerances no longer are ±.030 in. and ±2 degrees. They now are ±.002 in. and ±¼ degree," he reports.

His early work with computers is constantly being upgraded in the course of requirements of the job. "We are thoroughly computerized at Boeing."

About his job, Hizzey says: "I like my job! Heck, I wouldn't change it for anything. As a matter of fact, there's not much about it I don't like. I've been fortunate—I've had a lot of good assignments.

"With so many high spots, the low points occur from doing something mundane. I do find that our strict adherence to the structure and the discipline of our computer methods appears at times to be a nontechnical constraint, and it is not stimulating. But once the bookkeeping end of it is done, then the rest of it is fine," he remarks, adding: "What we are doing here offers a good opportunity for any good young person with a technical training and a manufacturing interest. We have more exciting challenges than we have good people to answer them."

Challenges seem to suit Hizzey. He climbs glaciers and mountains for sport.

It's on excellence. Excellence is what is going to get us into the future that we're visualizing for this company."

In everything the company's doing, he asserts the thrust is for long-range benefits—"growth in earnings, opportunities for our employees, role of corporate citizenship.

"We aren't limiting our thinking to short-term, bottom-line results."

Educational Gaps. In the early stages of the interviewing to produce this article, PRODUCTION's editors were looking to see whether manufacturing/industrial engineers several years out of college were in danger of being obsoleted by new hires who presumably had better knowledge of new manufacturing technologies.

What showed up instead is the woefully poor preparation students receive at most colleges and universities for manufacturing engineering careers. Glaringly missing, too, is guidance in career choices.

A scathing indictment of most schools offering a BS in Mechanical Engineering has been written by Prof. Jack T. Kimbrell, Dept. of Mechanical Engineering, Washington State University, based on a large-scale survey he made in more than 300 companies, discussing the ME's educational preparation with the person's immediate supervisor.

Looking at 25 topics believed needed by engineers—e.g., technology, materials, processes, reliability, communication, economics, etc., he found the engineers inadequately schooled in most of them. With respect to technology, he says: "The engineer's knowledge of hardware basic to all industry is very deficient." Re manufacturing processes, "the new engineer is by and large unaware of modern manufacturing processes. More disturbing is the fact that they have little or no appreciation of the influence of the process on the designs." Re metrology, "modern techniques for precision measurement of dimensions are virtually unknown." Re economics, "accounting procedures seem to be a mystery."

It now takes twice as long, he believes, to bring new engineers up to speed in industrial jobs than it did ten years ago. He concludes by saying that outside of California's "Silicon Valley" and a very few industries, "this surveyor found that they (ME graduates) are simply helping to maintain production levels and occasionally make improvements in products or processes. They are 'earning their keep' but are doing very little to reverse the rapidly deteriorating position of the United States as a leading industrial nation."

Profile: Larry Hoke

Age: 35
Title: Electronics Engineer, Truck Axle Div., Rockwell International
Location: Newark, OH
Education: Columbus (OH) Technical Institute, Associate degree in Mechanical Engineering
Marital Status: Married, two daughters

Since he joined Rockwell, right out of school, Larry's progress has been through a variety of departments and assignments rather than straight-line growth. After completing a four-year apprenticeship as a tool designer, he was a journeyman tool designer for two and a half years. Next, he moved into NC programming where he spent three years.

He then was chosen to be the line foreman of a Flexible Machining System when it was being installed and started up. "This job was a real challenge," Larry admits. "The Kearney & Trecker system originally had 11 machines in it. We since have added two Modu-Lines and removed three Turn-12s. All of us were new to the system—the operators, the maintenance personnel and supervision.

"Working with such a system is a lot different from working with stand-alone machine tools. You must have intimate knowledge of the computer and of the software. You have to know what must be done to keep the entire system running, and you have to know how to diagnose trouble—to know whether it is a machine problem or a control problem. This, of course, is in addition to the job of getting production out."

Hoke now has moved from direct supervision on that line to electronics engineering for the entire plant. His responsibility, and that of the four electricians who work with him, is to keep the plant's 48 NC machines running.

Hoke's short-range goal is to move up into maintenance management. "I'd like to be general maintenance foreman or to have moved into machine design or project management in five years, specifying and working on new equipment for the plant. I have applied to Franklin University in Columbus and plan to enroll in the fall.

"The major reason I like my current work is that every day represents a new challenge. There is little repetition. Also, I get to work with all of the latest electronic control technologies."

What does Hoke like least about his job? "Getting called at three o'clock in the morning to come in and handle an emergency."

An exception to the generally inadequate knowledge of what industry needs usually is at schools that offer a co-op program, where an introduction to the real world of manufacturing occurs on the job and in the orientation toward real-life situations that most of the schools' instructors have.

For graduates from most non-co-op schools, the choice of company/industry/job is mostly accidental and the first few years are "make-or-break," with the individual's self-motivating characteristics being all-important.

Some companies, such as TRW, Inc., provide an "intern" program, giving the new hires real responsibilities but moving them through a variety of job situations.

The ongoing educational opportunities of various kinds available to manufacturing engineers appear to be of greater benefit, by and large, than the undergraduate degrees they've received. The degree, in most cases, got them the job. But it stopped far short of giving the knowledge to progress in their organizations. To the credit of the Society of Manufacturing Engineers, its Education Foundation is helping provide funds, equipment and advice to many schools to upgrade the manufacturing processes curriculum.

Without the in-house courses, those seminars offered through appropriate professional societies and by various private organizations, and the financial support by their companies for further on-campus study, the manufacturing/industrial engineer—and his/her company—would appear to be seriously lacking in the knowledge and skills the future demands.

The educational system's vacuum is so obvious it has created an important new business opportunity for many previously non-educational organizations. One of these is the market research firm of Frost & Sullivan, Inc., New York, which this year established F & S Institute, Valley Stream, NY, under the management of Frank Massa. Its first programs are six-day-long workshops for designers (and users) of production equipment. Attendees bring actual problem-solving proposals from their companies for development at the workshop. At the first of these workshops a couple of months ago, projects included an automated assembly line incorporating robots, and a laser inspection station. Additional workshops are scheduled for Sept. 14 and Nov. 16.

Job Opportunities. All of the currently popular buzz words—"reindustrialization," "productivity," "cost improvement"—are the words of the manufacturing and/or industrial engineers' song.

(continued)

Profile: **John J. Demmer**

Age: 27

Title: Process Engineer, John Deere Engine Works, Deere & Co.

Location: Waterloo, IA

Education: BS in Mechanical Engineering, University of Iowa
Working on Masters degree in Engineering at Iowa State

Marital Status: Married

When a particular new boring machine is released to production in the John Deere Engine Works in the next few months "it'll have my 'name' on it," says John Demmer. As the process engineer responsible for that particular operation, John says the machine has been his project for a little more than a year and a half—from its selection, cost justification, request for appropriation, through to fixtures and tooling, try-out on the floor, and arranging for Quality Control's check-out of its precision capabilities.

John has been with the Deere Engine Works in Waterloo a little over two years. Upon graduation from the University of Iowa as a mechanical engineer, he went to work as a process engineer at Ford Motor Co.'s Sterling Heights, MI, plant processing the equipment for automotive drive shaft components. But the grass looked greener in his home state of Iowa so he went back there in April 1979, to a "showcase" diesel engine plant that has been in operation for about five years.

At this stage of John's career, his opportunity to see at close range both the product engineering and the manufacturing engineering processes is an advantage. "With a mechanical engineering background, I'm leaving myself open to go in either direction," he admits. John is half way through a Masters of Engineering program at Iowa State, which he thinks will help qualify him at some future date for an engineering management position.

Deere is providing him with abundant opportunity for development through its in-house programs, tuition payment for his Masters Degree study and encouraging attendance at seminars when they are appropriate to his job.

Manufacturing technology is changing very rapidly, he notes, and a source of some frustration is the feeling that "if you go out and buy a process now by the time you get it implemented it will be outdated," he remarks.

More flexible, more adaptable machines, therefore, are sought but these "are a lot more expensive than the ones they're replacing, so we're faced with some very tough decisions," he laments.

Developing the facilities (including human ones) to make products better and cheaper is these professions' reason for being.

Warren L. Halperin, executive director of the international executive search firm of MCS, Newport Beach, CA, a division of McSweeney & Associates, gives this analysis of the current opportunities and career ceilings for each of these professions.

"Historically, the industrial engineer has constituted the unsung hero of the manufacturing company. In the executive office, the image of the industrial engineer has been something akin to that of the 'green eye shade' accountant. During the past years we have seen a trend developing with the industrial engineer perceived in a new, truer light.

"The well-rounded industrial engineer has had experience in manufacturing techniques, EDP systems, organizational structure, labor utilization, facilities planning and utilization, transportation and distribution, and, in many cases, financial systems. His expertise cuts across most corporate functions.

"Combined with this multi-discipline experience is often an improved people management skill. This management skill comes as a result of his being an 'internal consultant' rather than an operations executive. The operations executive can effect necessary change implementation by simply mandating it to the subordinates who work directly for him. The IE cannot mandate change but must work through persuasion. He must be able to market his recommended change and win support for it. Hence, he works through motivating others, a key management tool of the executive office.

"Combining these factors makes the well-rounded IE a multi-faceted management leader, relative to an individual coming out of Finance, Marketing, Product Design, or Production only.

"We see a growing cognizance of the IE by top management as a result."

For the IE, Halperin has some hints with respect to educational preparation: "The ideal educational background would be a BSIE (or BS Engineering) combined with an MBA (preferably in Finance or General Management). The combination of an engineering undergraduate and advanced business degree provides a balance of the quantitative and the qualitative. In lieu of an advanced business degree, an MS in Engineering would be helpful. The nature of schools is also important but not critical. Doctorates are perceived as a negative in many cases; corporations perceive them as being often too theoretical rather than practical. The BSIE/MBA has a good edge in future career opportunities over the BSIE."

Halperin sees more of a career ceiling on the manufacturing engineer. "Generally, we find it exceedingly difficult for a production engineer to reach the top corporate spot. Most corporate heads having a production engineering background have either started their own company or are within a corporate environment with historical inordinate production

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Profile: **Michael J. Ryan**
Age: 27
Title: Production Engineer, Data Systems Div., Hewlett-Packard
Location: Cupertino, CA
Education: University College, Galway, Ireland—Bachelor's degree in Industrial Engineering
Santa Clara University—Now studying for Master's degree in Electronics Engineering
Marital Status: Married, wife is software engineer at HP's Santa Clara Div.

Electronics is Mike's avocation as well as his job. Born in New York City, Mike moved with his family to Ireland when he was six years old. As a boy, he was interested in electrical and electronic devices, and in college computers captured his main interest.

When he graduated from college in 1975, his first job was that of a computer programmer at a service bureau. He then worked for two years as a production engineer and then a manufacturing engineer, helping to establish a plant in Ireland for a division of Westinghouse. His projects included equipment and methods for assembly lines, a sheet metal fabricating plant and CNC tools.

"In 1978, I decided I wanted to be in the computer and electronics industry, so my wife and I moved to California. I interviewed with and was hired by Hewlett-Packard as a production engineer in the Palo Alto manufacturing division.

"After about a year, I moved to the Data Systems Division, working primarily on the manufacture of power supplies for computers. Right now, I am working on some products that will be introduced in about a year. My task is to help develop manufacturing and testing procedures for the new products, but I also am part of a series of producibility reviews in which we work with the product developers to help improve the producibility of the products."

With respect to his goals and objectives, Mike says: "I hope I can move into research and development, but not for several years. When I finished college I had aspirations to move up in problems. The 'Great American Dream' is still alive and well for the brilliant production engineer who can find a better way to build a needed product. But within an established corporate setting, the top floor corner emphasis will remain among the marketing and financial strategist types.

"However, heading up production in a major corporation isn't half bad, either," he exclaims.

"To reach career potential in manufacturing engineering," he adds, "the undergraduate degree is most important with advanced technical degrees an asset. The advanced degree is helpful but the lack of same is certainly not a significant liability."

An easily overlooked career opportunity for aggressive manufacturing engineers is spotlighted by Halperin.

"If an individual is financially motivated, extroverted, with a high energy level and aggressive, consulting firms offer exceptional opportunity," he points out.

"There are a number of outstanding manufacturing/oriented management consulting firms. These consultants may be ACME firms (Assn. of Consulting Management Engineers) or 'Big 8' CPA firms, the eight largest public accounting firms in the world. All of the Big 8 provide manufacturing consulting."

These organizations, he says, "have capable and qualified staffs who can consult on virtually any problem in the manufacturing process. Compensation is typically a good deal higher than in industry. As an experienced executive consultant, a person can reasonably aspire to a six-figure income. They also can reach substantial income levels at a relatively young age."

His company currently is conducting searches for BSIE/MBAs with prior manufacturing consulting experience at $60,000 or more compensation levels. Experience can be as little as 10 years.

He notes, however, that consulting work is not all roses! "To go into consulting requires above average communication skills. The hours are long and the travel is greater (than in industry). But so are the rewards."

Should I Change Jobs? Nearly all sizable manufacturing companies are looking now for manufacturing or industrial engineers. A vp-industrial relations at an East Coast aircraft/avionics firm says he has six requisitions for manufacturing engineers on his desk right now. The display classified ad sections of newspapers and professional journals bulge with attractive-sounding positions.

The greener-grass-on-the-other-side-of-the-fence syndrome, however, should not be forgotten. As our profiles indicate, opportunities for these men have abounded within their companies.

Looking at the pros and cons of your situation is a better first exercise than drooling over what some ad writer says his candidate-seeking company offers. PRODUCTION's Contributing Editor Dr. Ted Pollock,

manufacturing management and then into general management. Now I realize that I am more inclined toward research and development than I am toward management. I intend to keep working in manufacturing for a while. I still have much to learn, especially in our business where the technologies are changing so rapidly.

"Actually, I see our industry paying increasing attention to producibility in the future, whereas in the past our primary concern was in pushing the edge of technology with our products. As we now are faced with increasing cost competitiveness in the marketplace, manufacturing engineering finds itself with increasing emphasis and stature in our company.

"Introducing new products today is a team task. We have many meetings, with research and development, materials specialists, manufacturing engineering and others all sharing and contributing to the successful product introduction.

"But the problem is that the state of the art in electronics equipment moves so rapidly that we can't count on more than about two years for the product-development cycle. We must find ways to collapse the time between discovery and successful manufacture. Eventually, I want to take my manufacturing skills and knowledge into research and development so that at the same time the products are evolving producibility is made an original consideration and product feature."

Can he do this at HP? "Yes, I am confident I can. One of the very important aspects of our company is that every employee is an individual. We have open doors when it comes to expressing our ideas, and management is anxious to help us in attaining our personal goals and in helping us contribute to the company's goals. It probably is an unusual company in that regard. I am positive that if my objectives make sense, the company will help me fulfill them."

Ryan feels that his industrial engineering education was the best possible one for him. "Industrial engineering at Galway is a very general education. I studied electrical and mechanical engineering, operations research, accounting, industrial psychology, and even micro- and macroeconomics. I became aware of many disciplines, and I think I was in a perfect position to elect a specialty later."

His specialty, electronics, holds off-the-job fascination for him. He has a computer at home and is working on developing software building blocks for controlling robots.

who writes the popular monthly column "Strictly Personal," developed the "Job Satisfaction Quiz" that appears on page 102. It is designed to help you analyze the things related to your work and your company that are of major importance to you.

A "blow-your-own-horn" ability is crucial whether you are looking to advance in your own organization or seeking a spot in a more-enticing situation.

Consultant Halperin presents this picture of what companies want to know from candidates they're considering for IE or manufacturing engineering positions: "Critical to employers is implementation and quantified results. In the interviewing process, companies are interested in quantified results, be it in reduced overhead while maintaining productivity, or increased productivity while maintaining overhead, or, best of all, improved productivity while reducing overhead."

A candidate's ideal qualifications "will include emphasis on what the individual has accomplished rather than duties. Key words are: 'created,' 'initiated,' 'developed,' 'implemented.' Results achieved should be quantified wherever possible ('saved the XYZ Co.$xxxxx').

"The major error made by job seekers is to emphasize responsibilities rather than accomplishments. Companies are more interested in the latter. The good candidate should be able to show a prospective employer how he would be a profit center for that company."

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Verbal skills, Halperin says, are important. "The most common weakness in candidates is lack of personal marketing skills—selling their own accomplishments. This goes hand in hand with a weakness in communication skills."

In structuring their job requirements, companies, too, have weaknesses, Halperin says.

"Typically, the larger the corporation, the tighter the specifications are drawn." Where such tight requirements are indeed needed, he indicates, "is where the company has a specific major problem that the individual must be able to address." The production engineer who has encountered that problem and successfully resolved it will have the inside track; other criteria then become flexible.

What goes wrong in other cases, Halperin says, is in the hiring system. "The VP has a need and sends an authorization to Personnel to find a person. He sends a 'job description' and a list of 'candidate criteria.' The criteria tend to emphasize the ideal as it pertains

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Profile: Charles M. Stata

Age: 37
Title: Manager of High Technology, Advanced Manufacturing Development & Technology Section; Small Systems & Terminals Div., Honeywell Information Systems
Location: Billerica, MA
Education: Boston University—1 year, Engineering
Graceland College—Associate of Arts Degree in Communications. B.A. in Business Administration and Economics
Marital Status: Married, two children

Chuck Stata occupies a newly created position—manager of high technology in the Advanced Manufacturing Development & Technology Section of his organization. It would be logical to assume that the main thrust of his work is to introduce onto the manufacturing floor such state-of-the-art innovations as robotics, automation, lasers, CAM, etc. But that is not, in his view, where the contribution of his work will be greatest. More important, he feels, is the way the job interfaces with product design.

"This new position is a reflection of the realization that there has to be a more cooperative interaction between engineering and manufacturing, getting the manufacturing engineer into the scheme of things—into the loop—earlier," he explains.

"We spent a lot of time looking at robots and all the things that the Japanese are supposedly doing right. And we decided that the one most important thing they do that's different from what we have been doing here is taking a team approach to the design and manufacture of a product. This now is something we're driving toward. We now are actually participating at the initial stages of the design.

"If you were going to highlight one area that will affect engineering and manufacturing most in the rest of this decade it is this: The whole automation trend for increasing productivity will be in designing products that can be implemented effectively in the manufacturing environment.

"The real value of this approach comes when you can automate your *product* and not just your *process*. There's an important difference."

How well did his college studies prepare him for his newly created function?

"I have a very high mechanical aptitude and a fairly strong mechanical bent so I wanted to be in the manufacturing environment. But the one ability that has helped to the specific role. It is not intended as finite candidate criteria but more as a guide to the Personnel Department. A sophisticated personnel director reviews it, understands its intent and turns it over to one of the young recruiters. This recruiter, unfortunately, takes it literally and reviews resumes that meet the letter of the ideal candidate profile document rather than the intent.

"If you took a given corporate need and reviewed candidate requirements with the corporate recruiter and the department head (or VP) individually, you will find very substantial differences.

"The bottom line for all companies should be determining the objectives to be achieved by the new employee and finding the individual most skilled in achieving those objectives. All other criteria become secondary in importance."

Career 'Disopportunities.' A few cautionary notes also are sounded by Halperin. The first for IEs is "Don't leave manufacturing unless you really want to."

Currently, a large number of IEs in manufacturing companies are being hired away by non-manufacturing organizations. "By making the move away from a manufacturing environment, one starts to close off future doors," Halperin advises. "The IE will find substantial difficulty in returning to manufacturing environments at a more senior level. After a few years, they will find themselves either locked in to the current environment or required to take a step back to get into manufacturing again," he reports, adding that going into consulting does not constitute that hazard.

A second caution is to tread carefully. "When a company makes an error in an executive hire, it may be painful and embarrassing, but can be corrected (terminating the mistake). For the new employee it can be a darn sight more than painful or embarrassing—it can be disastrous to his life at that point in time."

He emphasizes: "In a mistake, the company always survives, only people get burned."

Explaining the importance to an executive search firm (which is engaged by a company to find and carefully screen candidates) of a good match between an individual and the job, Halperin adds: "The role of a responsible executive search firm is to objectively present an opportunity to an individual rather than sell him on a career change. Equally important is career planning with the candidate, to ascertain the compatibility of his goals with the reasonable growth expectation at the new potential employer. If a long-lasting, secure relationship is to be made, both must be able to meet each other's needs both short- and long-term." *Howard C. Tuttle* □

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me more than anything else is my communication skills. Whatever I am trying to do—solve an engineering problem or a management-related problem, in implementing the solution it ultimately comes down to a matter of communicating it," he asserts.

"I had an advantage from high school on that I worked part-time and in the summers. This gave me a fairly good idea of what industry was about and what I wanted to do. My main goal or drive or focus was on costs and cost reduction.

"In the jobs I've had since then, whether I've been working in manufacturing or marketing or whatever, the first question I ask myself is: 'How can I improve the cost picture?' "

This attitude has taken Chuck through a wide assortment of jobs, from the time he first hired into Honeywell in 1969 as a production engineer, then becoming a production planner, and later a cost analyst.

He left Honeywell, moving to the West Coast to become a materials requirements planner at Century Data Systems Div. of Calcomp and at Beckman Instruments he was variously a production control supervisor, cost engineer, production engineer and manufacturing engineer.

He came back East three years ago and rejoined Honeywell as a forecaster. He subsequently was named manager of forecasting and scheduling in the organization's Reseller and OEM Marketing Group; and immediately before his present position was created, he was principal production engineer in the Advanced Mfg. Development & Technology Section.

Gaining Time for Tomorrow's Solutions. The major problem manufacturing engineers have in traditionally structured organizations is the time bind they're typically in, Chuck contends. They are presented with a product design to be manufactured at maximum efficiency and with a tight time schedule for it. "I've found that when a person has responsibility for dealing with today's problems along with responsibility for tomorrow's, he never has the chance to look at tomorrow.

"We've worked to head-off that situation," he explains.

"As a new product comes toward implementation after we've had input at the design phase, we do a hand-off to advanced manufacturing—to the producibility and the testability groups. The advanced manufacturing groups make the pilot runs and the initial low-volume proof runs on the product, and from there it is transitioned to the manufacturing engineering groups for handling in the plant."

Because of Honeywell's high level of technology, Chuck considers his new job to be one that will be constantly changing and its responsibilities becoming progressively larger. It will be deeply involved, he notes, "with stretching the total organization's capabilities."

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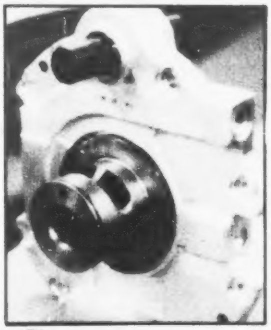
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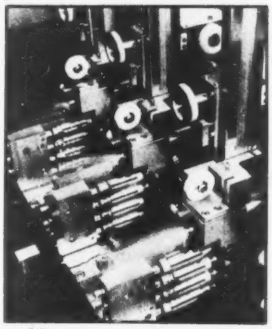
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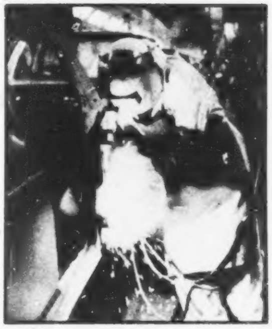
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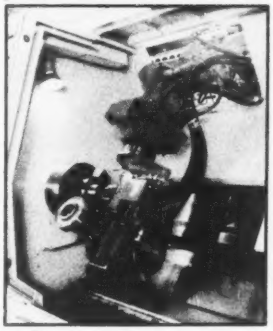
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Cover: The T³ robot reaching in to load/unload this turning center also serves a second machine and the associated gaging station

Next Month: Implementing Manufacturing Innovations—a PRODUCTION Round Table

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(continued)

the operating income of businesses. Because tax liabilities are based on inflated measures of profit and income, the proportion of correctly measured income paid in taxes rises with the rate of inflation. The primary distortions in business profits most alluded to arise through the overstatement of inventory holding gains and the understatement of the costs of capital."

Major influences in the overstatement of taxable profits include: Use of first-in, first-out (FIFO) inventory accounting which bases material costs on old, under-inflated values, thereby widening the gap between reported costs and the firm's current product prices; and use of a capital consumption, or depreciation allowance based on the original purchase price and failing to allow for inflation's effect on replacement costs over a period of time.

As the table on the preceding page indicates, by converting to LIFO (last-in, first-out) inventory accounting procedures, and by substituting allowed accelerated tax depreciation methods rather than straight-line calculations, taxable profits are reduced substantially, and they more accurately reflect the real condition of the business.

Bigger Defense Business

As President Reagan's defense spending programs go into place, there will be sizable boosts in contract awards. The Federal Reserve Bank of Philadelphia notes that defense outlays, which dropped to less than a quarter of the total Federal budget outlays in the late 1970s, is now estimated to rise to one-third of the total by 1984. This means that Defense will be increasing its share of GNP by about two-tenths of a percent a year.

A release from the Defense Department says the DOD budget calls for increasing civilian direct hires by 55,000 over 1980 levels by the end of 1982. Defense-related industries, supplying both hardware and services, are expected to need some 445,000 additional workers by the end of fiscal 1983, nearly half-a-million new jobs.

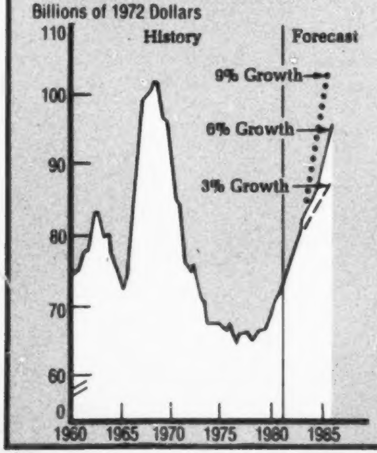
Three factors will have major influence on who gets in on the bulging business. First will be the industry involved. A report by Robert Gough, Data Resources Inc., a Massachusetts econometric forecasting firm, lists the ten industries (shown below) most likely to get the lion's share of the business.

A second factor is unavoidable; it's politics. The bank notes that statutes and regulations can require the government to pay some attention to local economic conditions in allocating contracts.

Third, DOD is increasing its emphasis on the cost-effectiveness of contractors as automated management information systems provide more and better data in better formats to people at the policy level. □

DEFENSE PURCHASES TO TAKE SHARP UPWARD TURN

Defense Purchases of Goods and Services Seasonally Adjusted Annual Rate



THESE INDUSTRIES MAY GROW

The Ten Industries Most Impacted by an Increase in Military Spending (Percent change in industrial production from six percent to nine percent growth in real military spending)

	1983	1984	1985	1986
New Military Facilities	1.9	5.0	8.0	13.4
Ammunition, Except Small Arms	1.8	5.0	7.7	12.8
Other Ordnance & Accessories	1.6	4.1	6.4	10.6
Complete Guided Missiles	1.3	3.7	6.0	10.2
Tanks & Tank Accessories	1.4	3.6	5.8	9.6
Small Arms Ammunition	1.2	3.2	5.1	8.5
New Industrial Buildings	0.4	2.0	4.6	8.1
Aircraft Engines & Engine Parts	1.2	3.2	5.0	8.0
Shipbuilding & Repairing	1.2	3.1	4.8	7.9
Aircraft Parts & Equipment	1.1	2.8	4.3	6.8

Source:
Robert A. Gough, Jr., "The Defense Budget: Issues and Outlook," materials presented at the Data Resources Quarterly Outlook Conference, New York, April 29, 1981.